PESTICIDES ABSTRACTS

July 1981 - Vol. 14, No.7
Abstracts 81-1801-2100
PSTAB 14(07) 521-587 (1981)

U.S. ENVIRONMENTAL PROTECTION AGENCY

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MANAGEMENT SUPPORT DIVISION
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PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstracts Bulletin) is a monthly publication of the Management Support Division of the Office of Pesticides and Toxic Substances, Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

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81-1801. Chvojka, R.; Williams, R. J. (New South Wales State Fish., Sydney, New South Wales 2000, Australia) **Mercury levels in six species of Australian commercial fish.** *Aust. J. Mar. Freshwater Res.* 31(4): 469-473; 1980 (3 references).

Data are presented on the mercury content of 6 Australian commercial fish. Between 13 and 30 individuals of each species were collected. Mercury content (total and methyl) was determined by the selective reduction method using flameless atomic absorption spectrophotometry (detection limit 0.01 mg/kg and recovery 95-105%). All mean mercury concentrations were low, although 1 tiger flathead and 5 sand whiting exceeded the mercury standard recommended by the NHMRC. The mean total mercury contents (in mg/kg) were: John dory 0.151, mirror dory 0.145, tigar flathead 0.236, rubberlip morwong 0.222, jackass morwong 0.267, and sand whiting 0.304. In the standard analysis, total mercury content was regressed against fish length; the resultant equations and correlation coefficients are presented for each species. It is concluded that mercury consumption is limited in the tested species.

81-1802. Ames, B., ed.; Infante, P., ed.; Reitz, R., ed. (Dep. Biochem., Univ. California, Berkeley, CA) **Ethylene dichloride: a potential health risk?** *Banbury Report* 5: 350 pp.; 1980.

A 20-chapter book is presented in which the current research on health effects of ethylene dichloride (EDC) is presented and evaluated. EDC is one of the highest volume chemicals produced and used in the world. It is used primarily as an intermediate in the production of vinyl chloride and other chemicals, and is also used as a solvent and a grain fumigant. Studies on the mutagenicity, carcinogenicity, and toxicology of EDC are presented, and occupational exposure to the compound is discussed. In addition, effects of related chemicals are considered. It is concluded that, although some of the data presented are conflicting, they do suggest a possible carcinogenic and mutagenic hazard. No evidence is presented to indicate that EDC causes birth defects or reproductive effects. Different effects due to route of exposure and different species are also discussed. The estimated population exposure to EDC is compared with established standards, and it is suggested that the relative human risk is low.

81-1803. Anonymous **Appendix.** *Banbury Report* 5: 347-350; 1980.

Results are presented of 2 separate analyses of an NCI sample of ethylene dichloride (EDC). The first sample was analyzed qualitatively by gas chromatography with flame ionization detection, gas chromatography-mass spectrometry, and gas chromatography-infrared spectrometry. Quantitative analyses were performed using gas chromatography with a flame ionization detector. EDC was assayed by comparison to a standard known to be 99.95% pure, and impurities were determined by external standard methods. The sample was determined to be 99.3% ± 0.23% pure, and 14 impurities are listed. In a second, independent analysis of the sample, gas chromatography-mass spectroscopy techniques were also used. The purity was found to be greater than 98%, and 13 contaminant peaks (principally chloroform) were detected.

81-1804. Mullet, J. E.; Arntzen, C. J. (Dep. Bot., Univ. Illinois, Agric. Res., SEA, USDA, Urbana, IL 61801) **Identification of a 32–34-kilodalton polypeptide as a herbicide receptor protein in photosystem II.** *Biochim. Biophys. Acta* 635(2): 236-248; 1981 (35 references).

Photosystem II particles which retained high rates of herbicide-sensitive activity were used to examine the site(s) of action of various herbicides. A polypeptide of 32-34 kdal was identified as the triazine-herbicide binding site based upon the parallel loss of atrazine activity and the polypeptide during either trypsin treatment or selective detergent depletion of protein in the photosystem II complex, and the covalent labeling of the polypeptide by a ^{14}C-labeled photoaffinity triazine. In photosystem II particles depleted of the 32-34 kdal polypeptide, electron transport was still active and was slightly sensitive to DCMU (diuron) and largely sensitive to dinoseb (urea and nitrophenol herbicides, respectively). On the basis of this result it is proposed that the general herbicide binding site common to atrazine, DCMU and dinoseb is formed by a minimum of two polypeptides which determine affinity and/or mediate herbicide-induced inhibition of electron transport on the acceptor side of photosystem II. (Author abstract by permission)

81-1805. Fiskesjo, G.; Lassen, C.; Renberg, L. (Inst. Genet., Univ. Lund, S-22362 Lund, Sweden) **Chlorinated phenoxyacetic acids and chlorophenols in the modified *Allium* test.** *Chem. Biol. Interact.* 34(3): 333-344; 1981 (17 references).

The genotoxicity of chlorinated phenoxyacetic acids was tested in a modified *Allium* test, based on onion exposures to test chemicals. The mean lengths of growing roots and chromosome damage were recorded. Test substances included 2-methyl-4-chlorophenoxyacetic acid (MCPA), 2,4-dichlorophenoxyacetic acid (2,4-D), 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) and 2,4,5-T butoxyethyl ester, 2,4-dichlorophenol and 2,4,5-trichlorophenol. MCPA was the most toxic of these chemicals. The chlorophenoxyacetic acids were more toxic than the 2 chlorophenols. Growth retardation was noted at < 0.1 ppm concentrations for the acids and at about 0.1 ppm for the ester and > 5 ppm for the phenols. *Allium cepa* was sensitive enough to respond to even low concentrations of these dicotyledon-selecting pesticides.

81-1806. Tu, C. M. (Res. Inst., Agric. Canada, London, Ontario N6A 5B7, Canada) **Effect of fungicidal seed treatments on alfalfa growth and nodulation by *Rhizobium meliloti*.** *Chemosphere* 10(1): 127-134; 1981 (13 references).

The relative toxicity of some broad spectrum protectant fungicide seed treatments to alfalfa growth and nodulation by *Rhizobium meliloti* was examined. The fungicides varied in their relative toxicity towards *R. meliloti* at different concentrations. Benomyl did not inhibit the organism. Zineb had only limited inhibition zones with the bacteria. However, captan, maneb and thiram caused greater toxic effects. A study of these chemicals at different levels on alfalfa seeds revealed that no injurious effect on germination was apparent when the treated seed was compared with the untreated in the agar-plate test. High levels of fungicide treatment suppressed crown nodulation in general. The treated plants exhibited smaller nodules scattered over the entire root system. Recovery from the inhibitory effect was rapid.

81-1807. Ndon, B. A. (Univ. Wisconsin, Madison, WI) **Inhibition of dinitroaniline herbicide action by plant lipids, and the role of dinitroaniline herbicides in the production of crops under double cropping systems.** *Diss. Abstr. Int. B* 41(9): 3265; 1981.

The effects of seed and root lipids on the susceptibility of plants to 2 substituted dinitroaniline herbicides were studied. Variability in lipid composition was observed in seeds of different plant species as well as cultivars within the same species. Susceptibility of plants to trifluralin and oryzalin decreased with an increase in percentage of total lipid in dry seeds. There was also a significant correlation between root lipid content and sensitivity to trifluralin and oryzalin. Seedlings grown from seeds with high lipid levels were observed to accumulate higher percentages of lipids in their roots and these roots were less susceptible than roots with lower lipid levels. Plant roots differed extensively in fatty acids composition but no single fatty acid appeared to uniquely influence trifluralin or oryzalin action. Treatment with trifluralin or oryzalin did not significantly alter the total lipid percentage or fatty acid compositions of roots. The influence of 7 dinitroaniline herbicides and tillage methods on the production of canning peas (*Pisum sativum* L.) and sweet corn (*Zea mays* L.) in a double cropping system was examined under field conditions. Visual observations of pea stand reduction as well as reduced shelled pea yields indicated that ethalfluralin at 0.84 kg/ha and trifluralin at rates in excess of 0.56 kg/ha were injurious to peas. The tillage and planting systems greatly influenced the sweet corn crop. The sweet corn population and yield were 15.6% and 14.4% higher, respectively, following conventional tillage methods than in the no-till area. The dinitroaniline herbicide residues resulting from pea treatment only affected the sweet corn when it was planted using the no-till system. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 8020576)

81-1808. Francklyn, L. (Sci. Unit, Natl. Public Radio, Washington, DC) **Debunking Madison Avenue: common sense *vs.* unconscionable chemistry.** *Environ. Action* 12(11): 22-24; 1981.

A commentary is reported on some of the controversial factors involved in regulating the use of hazardous substances. The discussion centers around Dow Chemical Company's manufacture of 2,4,5-T (Agent Orange). The company is pressuring the EPA to remove its ban on the use of 2,4,5-T and silvex on forests and food crops. Environmentalists cite increased miscarriages in sprayed areas as reason to keep the ban. Vietnam veterans are bringing legal charges against Dow regarding health effects due to Agent Orange; Agent Orange was more heavily contaminated with dioxin when used in Vietnam than the 2,4,5-T currently manufactured. Cases in which the company interprets data differently than do environmentalists, and cases in which information has been suppressed, are also cited.

81-1809. Sandhu, S. S. (Genet. Toxicol. Div., Health Effects Res. Lab., US EPA, Research Triangle Park, NC 27711) **Regulation of environmental pollutants: introductory remarks.** *Environ. Health Perspect.* 37: 1-3; 1981.

The long-term effects of atmospheric and water pollution and the use of pesticides on crops and food products are not fully understood. Industrialized countries are faced with the management of toxic waste products. Scientists must find ways to evaluate toxic substances for mutagenic and carcinogenic effects. Over 70,000 chemical compounds are in common use. Billions of gallons of industrial effluents are discharged to our lakes, rivers, and oceans each year. In 1977, 190 million tons of criteria air pollutants were emitted into the atmosphere. Several billion tons of solid wastes are disposed of legally and illegally each year. Since 1970, the US EPA has been responsible for the control of environmental pollutants. Efforts have been made to coordinate research and regulatory activities of federal agencies which control hazardous substances. To determine whether a substance can cause cancer, traditional epidemiological studies, animal bioassays, and short-term tests are utilized. Environmental monitoring methods are needed that assess the interactions of complex chemical mixtures. Efforts are being made to establish plant systems as valid monitoring mechanisms for mutagens. The advantages of using plants as screening systems for environmental pollutants are enumerated. Plants can also be used for *in situ* environmental monitoring and provide an inexpensive way of studying the chronic effects of pollution.

81-1810. Plewa, M. J.; Wagner, E. D. (Inst. Environ. Stud., Univ. Illinois, Urbana, IL 61801) **Germinal cell mutagenesis in specially designed maize genotypes.** *Environ. Health Perspect.* 37: 61-73; 1981 (59 references).

Plant genetic assays are good indicators of en-

vironmental mutagens and are used as *in situ* monitors of polluted air, water, and agricultural pesticides. The possible mutagenic properties of 32 pesticides to inbred W22 maize plants homozygous for *wx-C* were examined under modern agriculture conditions. Herbicides which induced a mutagenic response included cyanazine, SD50093 (atrazine + cyanazine) and procyazine + Dual (metolachlor). *In situ* and laboratory studies were conducted on three inbred strains of *Zea mays* to determine the action of environmental mutagens present in Chicago municipal sewage sludge. The frequency of mutant pollen grains in inbred M14 strains at both the *wx-C* and *wx-90* heteroalleles was measured in plants exposed to various concentrations of the sludge under field conditions. In laboratory tests, an inbred Early Early Synthetic strain was tested with the known mutagens ethyl-methanesulfonate (EMS) or maleic hydrazide (MH), and forward mutations at the *wx* locus were measured in the pollen grains. MH and EMS were mutagenic at levels of 10 nmol and 1 μmol, respectively. Levels of the mutants were calibrated in Early-Early Synthetic to a linear increase in the frequency of forward mutant pollen grains. A maize assay for environmental mutagens is being constructed to monitor forward or reverse mutations in somatic cells and cytogenetic changes in root-tip cells.

81-1811. Nriagu, J. O., ed. (Canada Cent. Inland Waters, Burlington, Ontario, Canada) ***Copper in the Environment. Part I: Ecological Cycling.*** *Environ. Sci. Technol. Ser.:* 522 pp.; 1979.

This section of the two part series on the biological, chemical, geological and clinical research of environmental copper discusses sources, distribution, behavior, and flow of copper in the environment. Specific topics included were the global copper cycle, copper in natural waters, aqueous environmental chemistry of copper, removal of copper from wastewaters, copper in soils and sediments, copper retention by soil and sediment components, copper in agricultural crops, cycling of copper in woodland ecosystems, the flow of copper through a terrestrial food web, the accumulation of copper in freshwater biota, and copper accumulations in coastal and marine biota. Abstracts of selected papers from this volume appear in the appropriate sections of this issue of *Pesticides Abstracts.*

81-1812. Nriagu, J. O., ed. (Canada Cent. Inland Waters, Burlington, Ontario, Canada) ***Copper in the Environment. Part II: Health Effects.*** *Environ. Sci. Technol. Ser.:* 489 pp.; 1979.

This section of the two part series on the biological, chemical, geological, and clinical research of environmental copper discusses the biological, ecological, and health effects of copper. Topics covered include environmental and occupational exposure to copper, human health effects of copper, teratogenic effects of copper, biochemical and pathological effects of copper deficiency, therapeutic uses of copper, copper homeostasis and metabolism in mammalian systems, copper toxicity studies using domestic and lab animals, toxicity of copper to aquatic biota, and the use of copper as a molluscicide. Abstracts of selected papers from this volume appear in the appropriate sections of this issue of *Pesticides Abstracts.*

81-1813. Breteler, R. J.; Valiela, I.; Teal, J. M. (William F. Clapp Lab., Battelle Columbus Lab., Duxbury, MA 02332) **Bioavailability of mercury in several North-eastern U.S. *Spartina* ecosystems.** *Estuarine Coastal Shelf Sci.* 12(2): 155-166; 1981 (42 references).

Data are reported on mercury concentrations in plants and organisms from salt marsh plots experimentally treated with mercury, and from marshes where heavy industrial pollution provided mercury for long periods. The experimental plots were treated twice monthly throughout the growing season with sewage sludge containing an approximate mercury content of 1 ppm during 1970-1976 or 1974-1976. Samples were taken during 1977 and 1978. Marshes contaminated by industrial sources of mercury were also sampled. The marsh cord grass *Spartina alterniflora* was collected, along with sediments, mussels, and fiddler crabs. All parts of *S. alternifora* showed an increase in mercury content with increasing mercury content of sediments, with roots showing the highest concentration. Marsh organisms living within the plots treated with sludge did not show an increase in mercury concentration. Mercury was closely associated with small detrital particles. It was concluded that the availability of mercury to plants and marsh invertebrates appears to increase exponentially with decreasing amounts of organic matter.

81-1814. Singh, R. M.; Singh, A. K.; Singh, R. B.; Singh, J.; Singh, B. D. (Dep. Genet. & Plant Breed., Banaras Hindu Univ., Varanasi 221005, India) **Chlorophyll mutations induced by seed treatment with certain insecticides in barley *Hordeum vulgare.*** *Indian J. Exp. Biol.* 18(12): 1396-1397; 1980 (7 references).

Seeds of hull-less barley cultivar IB 165 were treated with 0.05, 0.1 and 0.5% solutions of Ekatin (thiometon), Nuvan (dichlorvos), Ekalux (quinalphos), Metasystox (oxydemeton-methyl) and ethylmethane sulphonate (EMS). Chlorophyll mutants were noted in the EMS- and insecticide-treated populations, but not in controls. Six types of chlorophyll mutants were noted, including albina, xantha, viridis, chlorina, sigrina, and striata. Albina was the most frequent. All 4 insecticides induced mutation when applied during G2 phases of the cell cycle. Ekalux and Metasystox produced mutations during S phase, and did not cause mutations when applied during the G1 phase. Ekalux and Metasystox were more effective during S than during G2 phases.

81-1815. Goldblum, A.; Yoshimoto, M.; Hansch, C. (Dep. Chem., Pomona Coll., Claremont, CA 91711) **Quantitative structure-activity relationship of phenyl *N*-methylcarbamate inhibition of acetylcholinesterase.** *J. Agric. Food Chem.* 29(2): 277-288; 1981 (51 references).

A quantitative structure-activity relationship (QSAR) has been formulated for a set of 269 phenyl *N*-methylcarbamates inhibiting fly head acetylcholinesterase. The data are from the extensive studies of Fukuto and Metcalf. The correlation equation obtained is $pI_{50} = 0.56MR_{3\text{-}5} + 1.56MR_2 - 0.61E_{s3} - 0.94(\Sigma\,\sigma_{op}^{-} + \sigma_m)^2 + 1.43CHG - 0.23MR_3^2 - 5.24\mathcal{F}_{34}^2 + 3.4\mathcal{F}_{56} + 0.66RGMR - 0.62HB - 0.05MR_3^2 - 0.56E_{s2}\cdot E_{s6} + 3.46$ where $r^2 = 0.796$ and $s = 0.485$. In this expression MR refers to molar refractivity of substituents, E_s is the Taft steric parameter, $\mathcal{F}$ is an inductive parameter, RGMR refers to MR of certain parts of ring substituents, and CHG and HB are indicator variables for charged substituents and hydrogen bonding, respectively; r is the correlation coefficient and s is the standard deviation from the regression. The implication of this equation is discussed. (Author abstract reprinted by permission of the American Chemical Society)

81-1816. Miller, R. W. (Clin. Epidemiol. Branch, NCI, Bethesda, MD 20205) **Areawide chemical contamination. Lessons from case histories.** *J. Am. Med. Assoc.* 245(15): 1548-1551; 1981 (14 references).

Nine case histories illustrate the mounting problems owing to chemical contamination that often extends beyond the workplace into the community. The effects include not only carcinogenesis and teratogenesis, so much in the public's mind, but also severe neurological and gonadal disabilities immediately after exposure. The experience of the Atomic Bomb Casualty Commission in studying Japanese survivors in Hiroshima and Nagasaki serves as a model for future studies of communities exposed to unusual environmental contamination. Other incidents of environmental contamination discussed include chlordecone poisoning, human sterility caused by DBCP, lead pollution, Minamata disease, dioxin in Seveso, PCB poisoning in Japan, PBBs in Michigan, and Love Canal. (Author abstract reprinted by permission, modified)

81-1817. Jung, P. D. (Off. Pestic. Programs, US EPA, Beltsville, MD 20705) **Report on pesticide formulations: carbamate and substituted urea insecticides.** *J. Assoc. Off. Anal. Chem.* 64(2): 353; 1981.

The status of selected topics assigned to Associate Referees is discussed. Updates on analytical methods such as GLC, HPLC, and collaborative studies for determining residues of aldicarb, bendiocarb, carbaryl, carbofuran, methiocarb, methomyl, oxamyl, pirimicarb, and propoxur are given. Continuation of research on all of these carbamate pesticides is recommended.

81-1818. Launer, J. E. (Lab. Serv., State Dep. Agric., Salem, OR 97310) **Report on pesticide formulations: halogenated and other insecticides.** *J. Assoc. Off. Anal. Chem.* 64(2): 354; 1981.

The progress made by the Associate Referee in developing analytical techniques for halogenated and other insecticides is reported. HPLC techniques for captan, chlordimeform, dicofol, dylox (trichlorfon), rotenoids, and permethrin and GLC methods for *N*-octyl bicycloheptenedicarboximide, endosulfan, phenothiazine, chlordimeform, dylox, and piperonyl butoxide are discussed. Collaborative studies are being conducted on dicofol, pentachlorophenol (PCP), rotenone, and other rotenoids. Investigations into methods for tetradifon and continuation of all present projects is recommended.

81-1819. Bontoyan, W. R. (Chem. & Biol. Invest. Branch., US EPA, Beltsville, MD 20850) **Report on pesticide formulations: herbicides, fungicides, and miscellaneous.** *J. Assoc. Off. Anal. Chem.* 64(2): 355-356; 1981.

The General Referee has completed 2 collaborative studies and established a new general refereeship under the title of Microbial Mutagenicity Testing. This topic could be of importance for the regulators and producers of pesticides. The General Referee has subdivided pesticide formulation topics among 6 or 7 Associate Referees. The present status of analytical methods for aluminum phosphide, benomyl, bromacil, lenacil, bromoxynil octanoate, captan, chlorophenyl herbicides, chloroxuron, dicamba, dichlobenil, methazole, and nitrosamines is reviewed. The progress of studies on the sampling of pressurized cans and the volatility testing of hormone-type pesticides is reported. Recommendations of the General Referee include the adoption as official first action of a technique for the sampling of bactericide from pressurized cans, an infrared spectrophotometric method for methazole, a GLC method for terbutylazine, an atomic absorption spectrometric method for copper fungicides, and a GLC method for bromoxynil octanoate.

81-1820. Jackson, E. R. (Mississippi State Chem. Lab., Mississippi State, MS 39762) **Report on pesticide formulations: organophosphorus pesticides.** *J. Assoc. Off. Anal. Chem.* 64(2): 356-357; 1981.

The General Referee has obtained Associate Referees for the topics of fonofos, mevinphos, fenthion, fensulfothion, chlorpyriphos, dichlorvos, tetrachlorvinphos, phorate and EPN. Some organophosphorus compounds still require assignment as topics to be studied by Associate Referees. A collaborative study on an HPLC method for temophos is being conducted and a number of other collaborative studies are planned. GLC methods have been reported for acephate, crotoxyphos, diazinon, dichlorvos, dimethoate, disulfoton, EPN, ethoprop,

Bolstar, fenthion, fonofos, malathion, mevinphos, monocrotophos, naled, parathion and methyl parathion, encapsulated diazinon and methyl parathion, and phorate. HPLC procedures have been found for chlorpyriphos, coumaphos, crotoxyphos, EPN, ethion, fensulfothion, monocrotophos, naled, and methyl parathion. Infrared methods have been adopted for azinphos methyl and dioxathion. The General Referee has recommended continuation of the present work on these organophosphorus pesticides.

81-1821. Storherr, R. W. (Chem. & Biol. Invest., US EPA, Beltsville, MD 20705) **Report on carbamate pesticides, fumigants, and miscellaneous.** *J. Assoc. Off. Anal. Chem.* 64(2): 393-394; 1981.

Several inter-laboratory studies on analytical methods for carbamate pesticides, fumigants, and other pesticides have been conducted by the General Referee. Recommendations of the General Referee include the development of a GLC method for determining residues of carbamate insecticides as their silylated derivatives, an HPLC method for carbofuran residues in foods, a GLC method for ethylene oxide and its chlorohydrin, and a GLC technique for fumigants in food. The General Referee has also recommended the appointment of an Associate Referee for fenvalerate and the initiation of studies for permethrin. Studies will continue on the development of GLC methods for phosphine and sodium monofluoroacetate, and a collaborative study for developing analytical methods for the determination of resmethrin residues in food will be initiated.

81-1822. Newsome, W. H. (Food Res. Div., Health Protect. Branch, Health & Welfare Canada, Ottawa, Ontario K1A OL2, Canada) **Report on fungicides, herbicides, and plant growth regulators.** *J. Assoc. Off. Anal. Chem.* 64(2): 394-395; 1981.

Associate Referee reports have been received for anilazine, benzimidazole type fungicides, captan and related fungicides, chlorophenoxy alkyl acids, diquat, paraquat, dithiocarbamates, maleic hydrazide, 1-naphthaleneacetic acid (NAA) and 1-naphthalene acetamide, organo-tin fungicides, pentachlorophenol (PCP), substituted ureas and *s*-triazines. Many of the analyses rely on GLC or HPLC techniques. The General Referee has recommended collaborative studies for anilazine, chlorophenoxy alkyl acids, 1-naphthaleneacetic acid, 1-naphthalene acetamide, PCP, substituted ureas, atrazine, and cyanazine.

81-1823. McMahon, B. M. (Div. Chem. Technol., US FDA, Washington, DC 20204) **Report on organochlorine pesticides.** *J. Assoc. Off. Anal. Chem.* 64(2): 400-401; 1981.

Brief status reports for 9 of the Associate Referee projects on analytical methods for the detection of organochlorine pesticide residues are given. A GLC method for chlordane and inter-laboratory studies on TCDD, chlorobenzilate, chloropropylate, tetradifon, endosulfan, tetrasul, and bromopropylate are discussed. Quantitative techniques for PCBs and toxaphene are being conducted and the development of methods for dicofol, chlordecone, low moisture-high fat samples and multi-residue samples are being considered. The use of photochemical derivatization for the confirmation of residues is reviewed and the continuation of all present work by the Associate Referees, except the topic Multi-residues Methodology Extension, is recommended.

81-1824. McCully, K. A. (Health Prot. Branch, Health & Welfare Canada, Ottawa, Ontario K1A 1B7, Canada) **Report on organophosphorus pesticides.** *J. Assoc. Off. Anal. Chem.* 64(2): 401-403; 1981 (35 references).

The analytical methods for the determination of various organophosphorus pesticide residues are reviewed. Included among the techniques discussed are gas-liquid chromatography (GLC), high performance liquid chromatography (HPLC), gas chromatography-mass spectrometry with selective ion monitoring, and micro GLC procedures. No progress has been reported in the areas of confirmatory procedures, the analysis of organophosphorus residues in high fat samples, or sweep codistillation procedures. Inter-laboratory studies are being organized for the analysis of organophosphorus pesticide residues by thin layer chromatography. Recommendations for further research on cleanup and analysis methods, the formation of collaborative studies, and the development of multi-residue methods applicable to water are also made.

81-1825. Moore, H. P.; Hanks, A. R.; Zweig, G.; Collier, R. H.; Glocker, E. M. (Consumer Anal. Lab., State Dep. Agric., Reynoldsburg, OH 43068) **Report of Committee A on recommendations for official methods.** *J. Assoc. Off. Anal. Chem.* 64(2): 419-423; 1981.

Pesticides formulation analysis has been divided into 12 separate categories. Analytical updates are discussed for the determination of agricultural chemicals in animal feeds, water, plants, and tobacco products. Some of the residues to be determined include those of fertilizers, hazardous substances, insecticides, herbicides, fungicides, and organophosphorus compounds. The stability of organophosphorus pesticide standards will also be continued as a topic of study.

81-1826. Helrich, K.; Burke, J. A.; Malanoski, A. J.; Puma, B. J.; Butler, S. W. (Cook Coll., Rutgers Univ., New Brunswick, NJ 08903) **Report of Committee E on**

recommendations for official methods. *J. Assoc. Off. Anal. Chem.* 64(2): 432-440; 1981.

The recommendations of Committee E concerning analytical methods for carbamate pesticides, fumigants, fungicides, herbicides, plant growth regulators, metals, organochlorine and organophosphorus pesticides are reviewed. Multiresidue methods and inter-laboratory studies are discussed along with radioactive methods of analysis. Recommendations of Committee E for the analysis of pesticides in water and wastewater are also included.

81-1827. Bontoyan, W. R. (Off. Pestic. Programs, US EPA, Beltsville, MD 20705) **Report of the Twenty-Fourth Annual Meeting of the Collaborative International Pesticides Analytical Council (CIPAC).** *J. Assoc. Off. Anal. Chem.* 64(2): 455-458; 1981.

The 24th Annual CIPAC Meeting and Symposium, held in Granada and Salobrena, Spain in May 1980, resulted in a number of tentative specifications for pesticides which are important to the US EPA and pesticide producers. The symposium focussed on the analysis of pesticides in technical and formulated material. A list of CIPAC members, the countries they represent, and their corresponding organizations are given along with a list of chemicals studied and their code numbers. Status reports of various HPLC, spectrophotometric, IR spectrophotometric, TLC, and GLC techniques are given. Pourability, pour and tap bulk density, water, and water solubility tests are also reviewed.

81-1828. Anonymous **Changes in official methods of analysis made at the 94th Annual Meeting, October 20-23, 1980.** *J. Assoc. Off. Anal. Chem.* 64(2): 501-531; 1981.

Some changes in the Official CIPAC-AOAC methods of analysis at the 94th Annual Meeting are enumerated. Newly adopted methods which come under the topics of foods, animal and marine products, drugs, food additives, spices and condiments, vitamins, metals, dyes, fertilizers, and pesticide formulations are listed. The pesticides for which analytical techniques have been changed included copper fungicides, technical tetradifon, chlorpyrifos, and terbutylazine. An index which will be cumulative for actions on analytical techniques between editions of *Official Methods of Analysis* is also presented.

81-1829. Clegg, S.; Safe, S.; Crocker, J. F. S. (Guelph Waterloo Cent. Grad. Work Chem., Dep. Chem., Univ. Guelph, Guelph, Ontario N1G 2W1, Canada) **Identification of a toxic impurity in commercial diphenylamine.** *J. Environ. Sci. Health B* 16(2): 125-130; 1981 (7 references).

An impurity in commercial diphenylamine (DPA), a chemical used in industrial applications and as an anthelmintic and fungicide, has been reported to induce polycystic kidney disease in rats. The impurity known as contaminant E has been identified by gas liquid chromatography and mass and proton magnetic resonance spectrometry to be *N,N,N'*-triphenyl-*p*-phenylenediamine. The compound's identity was also confirmed by comparison with a synthetic standard produced by the Ullman coupling of iodobenzene and *p*-phenylenediamine or *N,N*-diphenyl-*p*-phenylenediamine. The impurity may be formed upon heating crude or purified DPA.

81-1830. Berry, D. L.; Campbell, W. F.; Street, J. C.; Salunkhe, D. K. (Dep. Nutr. & Food Sci., Utah State Univ., Logan, UT 84322) **Uptake and metabolism of 1,3-dichloropropene in plants.** *J. Food Saf.* 2(4): 247-255; 1980 (13 references).

Studies were conducted on the uptake and metabolism of Telone (1,3-DCPE; dichloropropene) by several species of plants. Bush beans, tomato and carrot plants were grown in sand or vermiculite and treated with labeled or unlabeled pesticide and its metabolite, 3-chloroallyl alcohol (3-CAA), at rates of 1×10^{-4} *M* Telone + 3×10^{-4} *M* 3-CAA and 3×10^{-4} *M* Telone and 3.2×10^{-4} *M* 3-CAA. At various time intervals, plant parts were collected and analyzed for the pesticide and its metabolites. Telone was rapidly absorbed and transformed to 3-CAA. 3-CAA in the plant medium was also rapidly taken up by the plants. Before the 1,3-DCPE was completely degraded and assimilated by the plants, it was converted to 3-chloro 1-propanol and 3-CAA. Neither of the test compounds were observed in the plants after 120 hr post-treatment. It appears that this soil fumigant does not present an environmental hazard because of its rapid, complete breakdown in plant tissues.

81-1831. Uhrig, H. (Max-Planck Inst. Zuchtungforsch., Erwin-Baur Inst., SAG Wenzel, D-5000 Koln-30, BRD) **Regeneration of protoplasts of dihaploid potato plants bleached by a herbicide (SAN 6706).** *Mol. Gen. Genet.* 181(3): 403-405; 1981 (12 references).

A method is described for establishing a phenotypic marker in dihaploid potato plants by bleaching plantlets with the herbicide SAN 6706 (metflurazone). Potato plantlets became completely white in color (chlorophyll-free) after 2 wk growth in SAN 6706-supplemented medium. Although the mechanism is not completely understood, the main cause of bleaching seems to be photo-oxidation of chlorophyll resulting from inhibition of carotenoid synthesis by SAN 6706. It was seen that protoplasts isolated from bleached plants were able to divide and regenerate, at least to a callus. Bleaching is reversible; greening of the calluses occurred after transfer to a medium which supports rapid callus growth and morphogenesis. The protoplasts isolated from treated shoots

divided at an earlier time and at a higher rate than did the green controls; possible reasons for this are discussed.

81-1832. Yukimoto, M. (Natl. Agric. Chem. Insp. Stn., Kodaira, Tokyo, Japan) **[Effects of organophosphorus insecticides on chlorophyll, carotene and carbohydrate content in Chinese cabbage leaves.]** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 6(1): 51-57; 1981 (10 references) (Japanese).

Changes in the amounts of chlorophyll, carotene and carbohydrate in the leaves of Chinese cabbage *(Brassica pekinesis)* after application of each of 15 different organophosphorus insecticides to seedlings were investigated. The effects of shading the plants before and after spraying were also examined. Decreased chlorophyll and carotene levels were observed after applications of fenitrothion, fenthion, phosalone, phenthoate, chlorpyrifos-methyl, and chlorfenvinphos. Chlorosis appeared to be due to the photodecomposition of chlorophyll, which in turn was due to a lack of carotene, in leaves of seedlings treated with phosalone and chlorpyrifos-methyl. Total carbohydrates were reduced in all cases, but no phytotoxicity symptoms appeared to be related to this phenomena. In all cases, shading the plants after spraying did not increase the appearance of phytotoxic symptoms. Necrosis and chlorosis were evident in young leaves after spraying with fenitrothion, fenthion, chlorfenvinphos, diazinon, methidathion, cyanophos, EPN, isoxathion, chlorpyrifos-methyl, malathion and Salithion. Yellowing of young leaves occurred after spraying with phenthoate, dialifor and phosalone. Dimethoate caused no phytotoxicity to young leaves.

81-1833. Carter, H. L.; Evans, M. A.; Waldron, A. C. (Ohio Crop Rep. Serv., USDA, Ohio State Univ., Columbus, OH) **Pesticide use on major crops in Ohio, 1978.** *Ohio Agric. Res. & Dev. Cent. Res. Bull.* 1117: 47 pp.; 1980.

This survey for major crops reported herein provides vital data for evaluating the impact of pesticide use in Ohio. About 45% of the Ohio farmers sampled in the survey responded to the questionnaire. Pesticides were applied to about 57.6% of the major crop planting acreage in Ohio in 1978 for weed control, to 16.1% for insect control and to 1.3% for disease control. Herbicide applications were made on 98.3% of the corn acreage, 97.4% of the soybean acreage, 100% of the sugarbeet acreage, 46.6% of the tobacco acreage and 26.9% of the small grain acreage. Weather conditions significantly effect the timing, method of application and quantity of pesticides used. Major herbicides used include trichloroacetic acid, pyrazon, alachlor, atrazine, butylate, cyanazine, chloramben, linuron, metribuzin, and trifluralin. Thiram was the most commonly used fungicide. The most frequently used protective clothing worn by farm operators included rubber goves and boots; 23% used goggles or face shields and 17% had tractors equipped with enclosed cabs. Potential water contamination from pesticide applications is not considered a significant problem in Ohio. Most farmers use acceptable methods in disposing empty pesticide containers.

81-1834. Akhtar, P.; Ahmed, J. (Dep. Bot., Univ. Karachi, Karachi 32, India) **Effects of herbicides on the rate of germination and respiration of cotton seeds.** *Pak. J. Sci. Ind. Res.* 23(1-2): 58-60; 1980 (9 references).

Germination trials were carried out on Whatman filter paper No. 1 in 10 cm diameter petri dishes, each containing 10 acid-delinted seeds of *Gossypium hirsutum* L. cv. M-100. Prometryne, Cotoron (fluometuron) and a mixture of each were applied at a rate of 440 ppm. Both the herbicides individually and their mixture reduced germination percentages. The rate of germination on the second day of the experiment was 52.37% for prometryne, 28.57% for Cotoron and 47.62% for the mixture-treated seeds. On day 3, these same ratios were 40.63, 34.38, and 31.25% for treatments of prometryne, Cotoron, and the mixture, respectively. Germination was abated in the Cotoron-treated seeds from day 4 onward. The germination rate on day 5 increased to 73.53% in prometryne-treated seeds. The germination rate in seeds treated with the mixture was 44.12% on day 5. Prometryne and Cotoron applications accelerated the uptake of oxygen by the seeds. The increased respiration and concomitant decrease in germination may be due to herbicide-induced uncoupling of oxidative phosphorylation. Combined dosing did not give evidence of synergism.

81-1835. Horvath, L.; Pulay, A. (Inst. Isot., Hungarian Acad. Sci., Budapest, Hungary) **Metabolism of EPTC in germinating corn: sulfone as the true carbamoylating agent.** *Pestic. Biochem. Physiol.* 14(3): 265-270; 1980 (13 references).

Studies were conducted on the metabolism of the thiocarbamate insecticide EPTC in corn. Corn seeds were germinated in water containing 10 mg [^{14}C]EPTC. After 4 days, roots and shoots were homogenized, extracted, and analyzed by thin layer chromatography. Three peaks were observed. The main soluble metabolite was carbamoylated GHS. Another experiment was conducted to compare the carbamoylating effects of EPTC, EPTC-sulfoxide, and EPTC-sulfone. Each compound was incubated with glutathione and analyzed after 1, 24, 96 and 240 hr. Neither EPTC nor EPTC-sulfoxide produced any conjugate with GSH, but the EPTC-sulfone reacted with GHS. *In vitro* assays of EPTC metabolism were conducted by homogenizing 5 day old seedlings and immediately adding either EPTC, EPTC-sulfoxide, or EPTC-sulfone. EPTC was partially oxidized to EPTC-sulfoxide, but EPTC-sulfoxide was not altered. EPTC-sulfone produced the 3 metabolites found in the germination experiment described above.

81-1836. Belbachir, O.; Matringe, M.; Tissut, M.; Chevallier, D. (Lab. Physiol. Cell. Veg., ERA, CNRS 847, Univ. Grenoble, F-38041 Grenoble, France) **Physiological actions of dinoterb, a phenol derivative. I. Physiological effects on the whole plant and on tissue fragments of pea.** *Pestic. Biochem. Physiol.* 14(3): 303-308; 1980 (11 references).

Studies were conducted to determine the effects of the herbicide dinoterb on tissue fragments and whole plants of the pea, *Pisum sativum*. Young plants were treated with 400 μM (sublethal) or 2 mM (lethal) concentrations of pesticide. Fragments of leaves (4 mm^2) were treated with 2 mM dinoterb. Chlorophyll levels were estimated, the N_2 content was estimated by the Kjeldahl procedure, and flavonal was determined spectrophotometrically. Photosynthesis and respiration intensities were measured concurrently. Dinoterb was found to rapidly inhibit photosynthesis in the whole plant, and had a necrotic effect on the leaves. Low dinoterb concentrations inhibited photosynthesis, uncoupled oxidative phosphorylation, and began to inhibit respiratory oxygen consumption. High concentrations of dinoterb caused necrosis several days after treatment.

81-1837. Belbachir, O.; Matringe, M.; Chevallier, D.; Tissut, M. (Lab. Physiol. Cell. Veg., ERA, CNRS 847, Univ. Grenoble, F-38041 Grenoble, France) **Physiological actions of dinoterb, a phenol derivative. 2. Effects on isolated plant mitochondria and chloroplasts.** *Pestic. Biochem. Physiol.* 14(3): 309-313; 1980 (12 references).

Isolated spinach chloroplasts and isolated potato mitochrondria were used in studies designed to determine the effects of the contact herbicide dinoterb on the electron transport chain. Dinoterb in various concentrations was added to the reaction mixtures and O_2 evolution was followed polarographically. The amounts of mitochrondrial proteins and chlorophyll were also determined. In potato mitochondria, dinoterb at low concentrations acted as an uncoupler of oxidative phosphorylation. At higher concentrations it inhibited the electron transport chain. In spinach chloroplasts, dinoterb stimulated oxygen uptake in the reduced dichlorophenol-indophenol methyl viologen couple, and also inhibited the Hill reaction. The inhibition site was located near photosystem II.

81-1838. Mattoo, A. K.; Pick, U.; Hoffman-Falk, H.; Edelman, M. (Dep. Plant Genet., Weizmann Inst. Sci., Rehovot, Israel) **The rapidly metabolized 32,000-dalton polypeptide of the chloroplast is the proteinaceous shield regulating photosystem II electron transport and mediating diuron herbicide sensitivity.** *Proc. Natl. Acad. Sci. USA* 78(3): 1572-1576; 1981 (28 references).

Information is presented concerning a rapidly synthesized thylakoid protein (molecular wt = 32,000) in *Spirodela oligorrhiza*, on NaDodSO4/polyacrylamide gels. This polypeptide is the main membrane component synthesized by the chloroplast protein-synthesizing system and is produced in quantities approaching those of the very abundant large subunit of ribulose-bisulfate carboxylase. Mild trypsin treatment of *Spirodela oligorrhiza* thylakoid membrane leads to partial digestion of the protein. Photoreduction of ferricyanide leads to insensitivity to diuron, an inhibitor of photosystem II electron transport. Preincubation of thylakoids with diuron leads to conformational changes in the 42,000-dalton protein, changing its trypsin digestion and preventing expression of diuron insensitivity. Light affects the susceptibility of the 32,000-dalton protein to trypsin digestion. Thylakoids specifically depleted in this particular protein were deficient in electron transport at the reducing side of photosystem II, but not at the oxidizing side or in photosystem I activities. The 32,000-dalton protein meets the requirements of the hypothesized proteinaceous shield, which regulates electron flow through photosystem II and mediates diuron sensitivity.

81-1839. Mallet, V. N. (Univ. Moncton, Moncton, New Brunswick E1A 3E9, Canada) **Aminocarb - effects of its use on environmental quality.** *Proc. Symp. Aminocarb, 1980.* 124 pp.; 1980.

Possible long term effects of aerially sprayed aminocarb, used to control budworm infestations in New Brunswick forests, have been examined in several studies and are reported at this symposium. The symposium was divided into three parts: formulations and methods of analysis, spray regimes and efficacy, and toxicological and environmental impact. Abstracts of papers presented at the Symposium on Aminocarb appear in the appropriate sections of this issue of *Pesticides Abstracts*.

81-1840. Sarrazin, R. (Minist. Tourisme & Pecke, Quebec, Quebec, Canada) **Historique de l'utilisation du Maticil et de ses effets sur l'environnement du Quebec. [History of the use of Matacil and its effects on the environment in Quebec.]** *Proc. Symp. Aminocarb, 1980.* p. 63; 1980 (French).

The Government of Quebec has conducted aerial insecticide dusting programs against spruce budworm since 1970. Matacil was used for the first time in 1973, and it has been used ever since in the various dusting projects throughout the province. A brief outline is given of the history of its utilization in Quebec along with the balance of its environmental effects, in particular of its effects on birds, mammals, and on the microfauna of creeks.

81-1841. Tkemaladze, G. Sh.; Chikovani, M. M. (Georgian Res. Educ. Vet. Inst., USSR) **Vliyanie 2,4-D na nad- i nadf-spetsifichnye glutamtdegidrogenazy v gorokhe.**

[Effect of 2,4-D on NAD- and NADP-specific glutamate dehydrogenases in pea plants.] *Soobshch. Akad. Nauk Gruz. SSR* 101(1): 145-148; 1981 (8 references) (Russian).

The effect of 2,4-D on NAD- and NADP-specific glutamate dehydrogenases was studied in roots and stems of 7-day pea shoots. 2,4-D was found to increase NAD-dependent GDH activity in both shoots and roots; the increase was dose-dependent. These findings indicated that 2,4-D induced *de novo* synthesis of NAD-dependent GDH. 2,4-D was found to markedly increase activity of NADP-dependent GDH in the roots, but did not affect NADP-GDH in the shoots.

81-1842. Doull, J., ed.; Klaassen, C. D., ed.; Amdur, M. O., ed. (Sch. Med., Univ. Kansas, Kansas City, KS) **Casarett and Doull's *Toxicology. The Basic Science of Poisons. (Macmillan Publ. Co. Inc.: NY):*** 778 pp.; 1980.

In this text a selective, representative view of the science of toxicology is presented. Unit I considers general principles of toxicology; topics included are the origin and scope of toxicology; evaluation of safety and toxicologic evaluation; absorption, distribution and excretion of toxicants; metabolism of toxic substances; factors influencing toxicology; chemical carcinogens; genetic toxicology and teratogens. Unit II covers systemic toxicology; toxic responses of the central nervous system, liver, kidney, respiratory system, eye, blood and reproductive system are presented. In Unit III toxic agents are discussed, including pesticides, metals, solvents and vapors, radiation and radioactive materials, plastics, toxins of animal origin and phytotoxicology. The topic of Unit IV is environmental toxicology; food additives and contaminants, air pollutants, and water and soil pollutants are considered. In Unit V the applications of toxicology are discussed, including forensic toxicology, clinical toxicology, occupational toxicology, regulatory toxicology, and toxicology and the law. Abstracts of chapters from this book will appear in the appropriate sections of this issue of *Pesticides Abstracts.*

81-1843. Klaassen, C. D.; Doull, J. (Sch. Med., Univ. Kansas, Kansas City, KS) **Evaluation of safety: toxicologic evaluation.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH02: 11-27; 1980 (30 references).

Toxicology is the study of adverse effects of chemicals on living organisms. Four areas of toxicology (descriptive, mechanistic, regulatory and forensic toxicology) are considered. The wide spectrum of toxic dose levels is described. LD50 values are presented for a variety of chemicals, including DDT, nicotine and TCDD. The concepts of risk and safety, and the evaluation of acceptable risk, are considered. The classification of toxic agents and the characteristics of exposure, including route, site, duration, and frequency of exposure, are discussed. The spectrum of undesirable effects of chemical exposure is presented, including allergic reactions, idiosyncratic reactions, immediate or delayed toxicity, reversible or irreversible toxic effects, local or systemic toxicity, and chemical interactions. Dose response, selective toxicity, descriptive animal toxicity tests and predictive toxicology are also discussed.

81-1844. Murphy, S. D. (Div. Toxicol., Med. Sch., Univ. Texas, Houston, TX) **Pesticides.** In: *Toxicology: The Basic Science of Poisons* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH16: 357-408; 1980 (245 references).

Benefit and risk evaluation of the economic and public health values of pesticides is discussed. The control of vector-borne disease, agricultural productivity, control of urban pests, environmental contamination, production and use statistics, human poisonings, and routes of exposure are considered. Acute poisonings by pesticides usually occur as a result of occupational exposures or careless use, misuse or mishandling of the product. Select examples of the various classes of insecticides are discussed in detail, including organophosphates, carbamates, organochlorines and botanicals. Signs and symptoms of acute poisoning, localized effects, systemic effects, delayed and neurotoxic effects, metabolism-toxicity relationships, and mechanism of action are considered. The diagnosis and treatment of poisoning cases are also discussed briefly. The herbicides considered include chlorophenoxy compounds, dinitrophenols, bipyridyl compounds, carbamates, substituted ureas, triazines and amides. Fungicides, rodenticides and fumigants are discussed. Special problems such as interactions, carcinogenesis, mutagenesis, teratogenesis, and comparative toxicology are also considered.

81-1845. Kilgore, W. W.; Li, M. Y. (Dep. Environ. Toxicol., Food Prot. & Toxicol. Cent., Univ. California, Davis, CA) **Food additives and contaminants.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH23: 593-607; 1980 (66 references).

The historic background of food additives, present status of food additives, intentional food additives and nonintentional food additives are discussed. Nonintentional additives found in human foods include pesticide residues. Toxicologic problems concerning food additives are considered. Criteria for determining the carcinogenicity of orally consumed substances is still in the formulative stages. A Carcinogenesis Report on Cancer Testing in the Safety Evaluation of Food Additives and Pesticides has been presented by the Food and Drug Administration Advisory Committee on Protocols for Safety Evaluation. A source of heavy metal contamination in foods is en-

vironmental pollution. Air pollution, fertilizer and pesticide residues, and industrial waste products have all contributed to the problem. Mercury poisoning has been reported in Niigate, Japan and New Mexico. In New Mexico a family was poisoned by consumption of pork from hogs which had been fed mill sweepings of mercury-treated grain.

81-1846. Nash, R. G. (Soil Sci., Pestic. Degradation Lab., Agric. Environ. Qual. Inst., Agric. Res., SEA, USDA, Beltsville, MD 20705) **Phytotoxic interaction studies – techniques for evaluation and presentation of results.** *Weed Sci.* 29(2): 147-155; 1981 (22 references).

Two or more pesticides together may produce a growth response in plants that is not predictable by their individual or independent toxicities. This unpredicted (dependent) response results from an interaction, a concept that usually is not easily interpreted. Dependent responses are further complicated by the fact that they can be either synergistic or antagonistic. Several methods exist for identifying and measuring phytotoxic interactions. Nearly all methods have certain shortcomings, however. Additive and multiplicative models (mathematical expressions) are the 2 basic approaches to determining pesticide interactions. The 2-parameter, isobole, and calculus-methods are additive; whereas, Colby and regression estimate are multiplicative models. Regression estimate analysis considers derivations due to experimental errors, and a statistical significance can be attached to the interaction magnitude, thereby overcoming the deficiencies of the Colby method, but methods seem to be limited to response data in which the combined pesticide concentration is the sum of the individual pesticide concentrations. The 2-parameter method seems to be limited to response data in which the combined concentration is equal to the individual pesticide concentration and to response data in which a pesticide concentration necessary to produce a 50% of control value is interpolated rather than extrapolated. The calculus method is a mathematical expression of the growth response, and interaction is measured by derivation of the equation obtained. The calculus method is difficult to interpret and has a major weakness because it depends upon the multiple regression equation of the observed data. The regression estimate method is recommended as a reasonable approach to interpretation of interaction type data, with a SAS language computer program available from the author. (Author abstract by permission)

81-1847. Kunert, K. J.; Boger, P. (Lehrstuhl Physiol. & Biochem. Pflanzen, Univ. Konstanz, D-7750 Konstanz, BRD) **The bleaching effect of the diphenyl ether oxyfluorfen.** *Weed Sci.* 29(2): 169-173; 1981 (30 references).

The diphenyl ether, oxyfluorfen [2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene], exerts a very strong and rapid bleaching effect upon intact microalgae such as *Scenedesmus acutus*. Carotenoids, and subsequently chlorophylls, are destroyed concurrently with ethane formation and inhibition of photosynthetic oxygen evolution. These herbicidal effects are not observed before an activation time of approximately 2 hr, during which photosynthetic electron transport is necessary. Diuron [3-(3,4-dichlorophenyl)-1,1-dimethylurea] inhibits oxyfluorfen activity during this activation time, but not thereafter. Isolated spinach chloroplasts (*Spinacia oleracea* Atlanta) evolve ethane after a light-incubation phase in the presence of oxyfluorfen as well as paraquat (methylviologen, 1,1'-dimethyl-4,4'-bipyridinium ion). Depending on their chemical constitution, diphenyl ethers apparently act differently and multifunctionally. The effects described for oxyfluorfen are believed to represent the primary mode of action of bleaching diphenyl ethers. (Author abstract by permission)

81-1848. Jeffery, L. S.; English, J. R.; Connell, J. (Dep. Plant & Soil Sci., Univ. Tennessee, Knoxville, TN 37916) **The effects of fall application of glyphosate on corn *(Zea mays)*, soybeans *(Glycine max)*, and johnsongrass *(Sorghum halepense)*.** *Weed Sci.* 29(2): 190-195; 1981 (30 references).

Glyphosate [Nphosphonomethyl) glycine] was applied at various stages of maturity to corn (*Zea mays* L. Pioneer brand 3147 and Dekalb XL 394), soybeans [*Glycine max* (L.) Merr. Forrest and Essex], and johnsongrass [*Sorghum halepense* (L.) Pers.]. Glyphosate applied over-the-top of corn before the grain moisture level decreased to 30% (black layer will have been formed) caused various seed and subsequent progeny abnormalities. Depending on grain moisture level at the time of glyphosate application, seed wt was sometimes reduced and progeny seedling emergence, vigor, and wt were reduced. Also, abnormal seedlings, albino or striated, occurred. Glyphosate applied 2.5 wk or more before soybean maturity reduced seed wt, caused seed discoloration, and drastically reduced progeny seedling emergence, vigor, and wt. Glyphosate applied in September or early October controlled semimature johnsongrass. Later applications were less effective because of advanced senescence. (Author abstract by permission)

81-1849. Smid, D.; Hiller, L. K. (Dep. Hortic. & Landscape Archit., Washington State Univ., Pullman, WA 99164) **Phytotoxicity and translocation of glyphosate in the potato *(Solanum tuberosum)* prior to tuber initiation.** *Weed Sci.* 29(2): 218-223; 1981 (24 references).

Field and greenhouse experiments were conducted to observe and measure the phytotoxicity of glyphosate [*N*-(phosphonomethyl) glycine] to potatoes (*Solanum tuberosum* L. Russet Burbank) applied at different stages of growth and to determine if glyphosate was translocated

into the original mother tuber (seed piece) prior to initiation of daughter tubers. Glyphosate injury symptoms appeared 1 day after treatment and at least 50% of the foliage was necrotic within 7 days. Significant-decreases in plant height, shoot and root dry matter content, and daughter tuber production were recorded at the 0.28- and 0.56-kg/ha rates. Higher rates of 1.12 and 2.24 kg/ha did not give further significant reductions. Maximum levels of ^{14}C activity accumulated in all plant parts 4 days after application of the ^{14}C-glyphosate. The ^{14}C-glyphosate accumulated primarily in the apical meristem and roots. Extremely low levels of ^{14}C activity were detected in the mother tuber regardless of plant age when treated. Phytotoxic effects on the eyes of the mother tuber increased in severity with increasing rates of glyphosate as evidenced by abnormal sprouting. (Author abstract by permission)

81-1850. Marquis, L. Y.; Comes, R. D.; Yang, C. P. (Agric. Res., SEA, USDA, Prosser, WA 99350) **Absorption and translocation of fluridone and glyphosate in submersed vascular plants.** *Weed Sci.* 29(2): 229-236; 1981 (21 references).

The uptake and translocation of fluridone [1-methyl-3-phenyl- 5-[3-(trifluoromethyl) phenyl] 4(1H)-pyridinone] were examined in sago pondweed (*Potamogeton pectinatus* L.) and Richardson pondweed [*Potamogeton richardsonii* (Ar. Benn.) Rydb.]. Root and shoot tissues of both species were isolated from each other with wax barriers and treated individually with 1.0 ppm ^{14}C-fluridone. Both tissues bioconcentrated fluridone, but the amount absorbed represented 1% or less of the total herbicide available. Limited root-to-shoot translocation occurred, but shoot-to-root transport was negligible. In contrast to fluridone, highly mobile glyphosate [*N*-(phosphonomethyl) glycine] translocated from the shoots to the roots in sago pondweed. No metabolism of fluridone was detected in sago pondweed. (Author abstract by permission)

81-1851. Boldt, P. F.; Putnam, A. R. (Dep. Hortic. Sci. & Landscape Archit., Univ. Minnesoa, St. Paul, MN 55108) **Selectivity mechanisms for foliar applications of diclofop-methyl. II. Metabolism.** *Weed Sci.* 29(2): 237-241; 1981 (15 references).

The fate of foliarly applied ^{14}C-diclofop-methyl {methyl 2-[4-(2,3-dichlorophenoxy propanoate} was determined in intact plants of barnyardgrass [*Echinochloa crus-galli* (L.) Beauv.], a susceptible (S) grass; proso millet (*Panicum miliaceum* L.), a moderately susceptible (MS) grass; longspine sandbur [*Cenchrus longispinus* (Hack.) Fern.], a tolerant (T) grass; soybean [*Glycine max* (L.) Merr. Hark], and cucumber (*Cucumis sativus* L. Green Star), both T broadleaf plants, 1, 3, and 5 days after treatment (DAT). Diclofop-methyl accounted for 94% of the radioactivity washed from the leaf surfaces of all species. Plant extracts contained diclofop-methyl, diclofop, and water-soluble conjugates. Barnyardgrass (S), proso millet (MS), and soybean (T) had 75, 68, and 66% of the extracted radioactivity as diclofop and diclofop-methyl. Longspine sandbur (T) and cucumber (T) had 71 and 84% of the extracted radioactivity as water-soluble conjugates. Acid hydrolysis of the water-soluble conjugates yielded 84 and 71% diclofop in barnyardgrass (S) and proso millet (MT). Cucumber (T), soybean (T), and longspine sandbur (T) had 43, 23, and 25% ring-OH diclofop. Alkaline hydrolysis of the non-extracted plant residue yielded diclofop as the major component in all species. (Author abstract by by permission)

81-1852. Monroe, C. B. (Corp. Health & Saf., Rohm & Hass Co., Bristol, PA 19007) **The role of biological monitoring in medical and environmental surveillance.** *ACS Symp. Ser.* 149: 223-233; 1981 (22 references).

The application of biological monitoring in industrial hygiene and occupational medical surveillance programs is examined. Occupational biological monitoring is defined as tests administered to workers to measure body uptake of toxicant as an index of exposure, or to detect pathophysiologic effects of the toxicant as an index of toxicity. In the case of occupational exposure to a cholinesterase inhibiting pesticide, measurement of blood levels of the pesticide or biotransformation product is recommended to monitor body uptake. For monitoring the medical effect of exposure, it is recommended that blood cholinesterase be measured. Biological monitoring is related to other occupational medical surveillance techniques. The importance of informing workers of the purpose of the tests and the practical meaning of test results is discussed. In environmental surveillance the goal of biological testing is to evaluate the exposure quantity of the hazard potential posed by a toxic substance. In medical surveillance, biological monitoring is a preventive medical tool used to discern the human toxicity of potential toxicants at exposure levels present in the workplace. A properly designed biological monitoring program should be developed conjointly by environmental engineering and medical staffs using environmental data about the nature of the workplace exposure and medical knowledge about the prevalence of medical conditions that might alter the susceptibility of individuals to the contaminant. Biological monitoring should begin with the selection of a test with an outcome that is appropriate to the type of surveillance conducted. Medical-legal aspects of biological monitoring are also discussed.

81-1853. Kovac, J.; Kovacicova, J.; Batora, V.; Kus, L. (Res. Inst. Agrochem. Technol., Bratislava, Czechoslovakia) **Rezidua trimorfamidu v pol'nohospodarskych plodinach. [Trimorfamid residues in agricultural products.]** *Agrochemia* 21(2): 44-47; 1981 (9 references) (Slovak).

Trimorfamid is a systemic fungicide developed by the Research Institute of Agricultural Technology in Bratislava for control of *Erysipaceae* in tobacco, grapevines and other field crops. Residues were determined by gas chromatography with EC detection in a number of treated crops to assess the potential risk to consumers. The crops were treated repeatedly during the vegetation period, and residues were determined up to 20 days following the last treatment. Residues decreased most rapidly in cucumbers, grapes, tomatoes, apples, currants, and barley. In all samples, levels decreased to below 0.05 mg/kg on day 10 following treatment, except in the case of barley where the residue was 0.78 mg/kg 20 days following the treatment. Due to the relatively low toxicity of trimorfamid to mammals (rat LD50, 2550 mg/kg) it is concluded that these residues do not represent a hazard to consumers.

81-1854. Paris, D. F.; Steen, W. C.; Baughman, G. L.; Barnett, J. T., Jr. (Environ. Res. Lab., US EPA, Athens, GA 30613) **Second-order model to predict microbial degradation of organic compounds in natural waters.** *Appl. Environ. Microbiol.* 41(3): 603-609; 1981 (17 references).

Microbial degradation of 3 pesticides that undergo hydrolytic degradation was studied in waters from 40 sites in 18 states. The rates of degradation conformed to second-order kinetics; that is, the rates were proportional to both bacterial and xenobiotic concentrations. Rate constants for organic compounds degradation in natural waters were as follows: 2,4-dichlorophenoxyacetic acid (2,4-D) butoxyethyl ester (DBE), 1.5 to 12.0×10^{-10}; malathion, 2.5 to 6.3×10^{-11}; and chlorpropham, 1.3 to 4.9×10^{-14}. Half lives for each compound were 2.6 hr, 2,4-DBE; 32 hr, malathion; and 53,000 hr, chlorpropham.

81-1855. Kruse, R.; Krueger, K. E. (Staatlichen Veterinaerunters. Fische & Fischwaren, D-2190 Cuxhaven, BRD) **Organochlorpestizide in der Leber des Ostseedorsches – Eine aktuelle Bestandsaufnahm. [Organochlorine pesticide residues in Baltic Sea cod – an inventory.]** *Arch. Lebensmittelhyg.* 32(1): 26-28; 1981 (8 references) (German).

Liver samples from cod caught between August 1978 and November 1979 in 6 different fishing grounds of the Baltic Sea were analyzed by gas chromatography for organochlorine pesticide residues. Liver of this fish is used as raw material for cod liver oil manufacture. Generally, a positive correlation was found between residue values of ΣDDT, hexachlorobenzene (HCB), dieldrin and α-HCH (α-BHC) and specimen size and age. ΣDDT concentrations are decreasing yearly as a result of the DDT ban. However, it is predicted that occasional catches will continue to exceed the maximum permissible limit of 5 ppm for some years to come. The results of the analyses reveal decreasing residue levels. Median values for 1978, 1979 and 4 mo of 1980 were: ΣDDT 2.471, 1.671 and 1.325 ppm; HCB 0.078, 0.045 and 0.044 ppm; dieldrin 0.078, 0.154 and 0.074 ppm; and HCH 0.016, 0.054 and 0.041 ppm, respectively.

81-1856. Bidleman, T. F. (Dep. Chem., Univ. South Carolina, Columbia, SC 29208) **Interlaboratory analysis of high molecular weight organochlorines in ambient air.** *Atmos. Environ.* 15(4): 619-624; 1981 (11 references).

High volume air samples were taken by pulling air through a glass fiber filter followed by plugs of polyurethane foam. Samples were taken on the roof of a building ~ 30 m above street level in Columbia, South Carolina. Samples were similarly taken in Boston, Massachusetts. Each analytical lab was required to report total ng of PCBs and chlorinated pesticides in the 5 ml sample vials. Average ΣPCB concentrations were 7.1 ng/m^3 in Boston and 4.4 ng/m^3 in Columbia. Organochlorines identified by at least 3 laboratories included hexachloro-

benzene, (HCB), DDT, DDE, chlordane, dieldrin, endrin hexachlorocyclohexane (BHC) and polyterpenes. Average levels in Columbia and Boston, respectively, in ng/m³ were > 0.12 and > 0.057 HCB, 0.27 and 0.025 *p,p'*-DDT, 0.03 and < 0.06 *p,p'*-DDE, 5.9 and 0.72 chlordane, 0.40 and 0.033 dieldrin, 0.20 and ND endrin, 0.37 and 1.7 α-BHC, and 0.18 and 0.17 γ-BHC (lindane). Precision for pesticide reporting was in general lower than for PCBs. Relative standard deviations ranged from 26-39% for PCBs, 35-75% for most pesticides, and as high as 116% for polychloroterpenes quantified as toxaphene. These results provide an indication of the interlaboratory precision that can be expected for the analysis of organochlorines in urban air in a single-round sample distribution, and also allow a comparison of the PCB and pesticide levels in 2 distinctly different US cities. It was concluded that the precision of measuring airborne organochlorines was limited mainly by the analytical variability, not the sampling variability.

81-1857. Fishbein, L. (Natl. Cent. Toxicol. Res. Jefferson, Food & Drug. Admin., Dep. HEW, AR 72079) **Production, uses and environmental fate of ethylene dichloride and ethylene dibromide.** *Banbury Report* 5: 227-238; 1980 (45 references).

A review is presented in which the halogenated aliphatic hydrocarbons ethylene dichloride (EDC) and ethylene dibromide (EDB) are discussed. EDC is produced primarily by the vapor or liquid phase reaction of ethylene and chlorine. EDC is an intermediate insecticidal fumigant, active against peach tree bores, Japanese beetle and root-rot nematodes. Because of volatilization, this compound easily enters the atmosphere. It also has been found to pollute water. Of 80 water supplies tested in 1974, 26 had levels of 0.2-31 μg EDC/l. There is no indication that EDC bioaccumulates. Based on the National Cancer Institute's findings, a standard of 1 ppm (4.5 mg/m³) has been recommended. EDB is produced by liquid phase bromination of ethylene. The primary source of atmospheric contamination by EDB is from auto exhaust. The compound is used as a fruit, vegetable and grain fumigant. The highest health hazard is to workers in fumigation facilities. There are a variety of current and proposed standards for atmospheric levels of EDC ranging from 1 mg/m³ to 380 mg/m³.

81-1858. Clark, D. R., Jr. (Patuxent Wildl. Res. Cent., US Fish & Wildl. Serv., Laurel, MD 20611) **Death in bats from DDE, DDT or dieldrin: diagnosis via residues in carcass fat.** *Bull. Environ. Contam. Toxicol.* 26(3): 367-374; 1981 (18 references).

Known bat brain-to-carcass lipid relationships for DDE, DDT and dieldrin were compared for different bat species and to birds. Data were gathered from several different studies. Data from bats of three species fed DDE were plotted together and fitted to a single regression line, since covariance analysis indicated that individual species relationships were not significantly different. Other bats did not yield data which would fit this curve. The data do suggest that when bats of the same age category are examined and when analyses are performed by the same methodology, the relationships found may apply to several species. Conditions for the use of carcass lipid concentrations for diagnosis of organochlorine poisoning seem to be no more restrictive than those for use of brain concentrations. It is concluded that estimated minimum lethal concentrations in carcass lipids can be used to determine DDE, DDT or dieldrin induced mortality if they are expressed in ppm concentrations. It is suggested that bats and birds in museum collections can be examined for these organochlorine residues and pesticide induced mortality could be determined.

81-1859. Frank, R.; Sirons, G. J.; Wilson, D. (Prov. Pestic. Residue Test. Lab., Ontario Minist. Agric. & Food, Guelph, Ontario N1G 2W1, Canada) **Residues of 4-aminopyridine in poisoned birds.** *Bull. Environ. Contam. Toxicol.* 26(3): 389-392; 1981 (8 references).

Dead or dying birds were collected between 1976 and 1978 from sites where 4-aminopyridine (4-AP) had been used to discourage birds. Treated cereal or corn bait was mixed with untreated grain to reduce 4-AP concentrations to 0.03%. Levels were later determined to be ∼ 18 mg/kg. House sparrows and domestic pigeons were collected at the treated sites while herring gulls were collected between the sites and up to distances of 5 km. Most pigeons, sparrows and 1 redwing blackbird died within a few min of consumption. Some survived, however, for up to 90 min in states of acute toxicity. Contents of the crop, proventriculus and gizzard of all 4 species ranged from 0.5 to 92 mg/kg. In the short period between consumption and death, 4-AP appeared in all tissues of the birds. The lethal dose for herring gulls and domestic pigeons was similar; 4.0 and 4.4 mg/kg, respectively. The lethal dose for house sparrows was 1.4 mg/kg.

81-1860. Gras, G.; Hasselman, C; Pellissier, C.; Bruggers, R. (Lab. Chim. Anal. & Toxicol., Fac. Med. Pharm., Dekar, Senegal) **Residue analysis of methiocarb applied to ripening sorghum as a bird repellent in Senegal.** *Bull. Environ. Contam. Toxicol.* 26(3): 393-400; 1981 (22 references).

Methiocarb was applied by motorized backpack sprayer at a rate of 2 kg/80 *l* water/ha to milk-stage sorghum in a 46 m² area on 30 January 1978. Adhesive/spreader Triton AE was added to the formulation at 60 ml/100 *l* water. Grain and grain heads were collected immediately after spraying and at 12 hr, 24 hr, and 5, 10, 15, 20, 25, and 30 days after spraying. Quantitative thin layer chromatographic analysis was performed for methiocarb and its principal metabolites; spot intensity was

linear from 0 to 250 ng methiocarb. Residue degradation curves were constructed and the half-life of methiocarb was calculated to be 7 days. The optimal safety interval between last spray and harvest was calculated to be 20-23 days. During analysis of the treated samples, methiocarb alone was identified at 5 days and methiocarb sulfone was detected after 5 days. Neither methiocarb sulfoxide nor 4-(methylthio)-3,5-dimethylphenol were detected.

81-1861. Yamagishi, T.; Kaneko, S.; Miyazaki, T.; Akiyama, K.; Horii, S. (Tokyo Metrop. Res. Lab. Public Health, Shinjuku-ku, Tokyo 160, Japan) **Oxychlordane, *trans*-nonachlor and *cis*-nonachlor residues in adipose tissues of dogs and cats collected in the Tokyo area.** *Bull. Environ. Contam. Toxicol.* 26(3): 407-412; 1981 (13 references).

A total of 51 adipose tissue samples, from 15 female and 26 male dogs and 5 female and 5 male cats, was obtained from the Metropolitan Tokyo animal shelter. Oxychlordane, *trans*-nonachlor and *cis*-nonachlor were found in all samples. No detectable levels of other chlordane components were found. The average levels of Σchlordane components in cat samples were 160 ppb; twice as high as in dogs. The ratios of oxychlordane, *trans*-nonachlor and *cis*-chlordane were 1:1:1 in cats and 4:1:0 in dogs. Levels in dog adipose tissue were 3-6 times higher than those reported for human milk (fat basis).

81-1862. Makary, M. H.; Riskallah, M. R.; Hegazy, M. E.; Belal, M. H. (Cent. Lab. Pestic., Agric. Res. Cent., Dokki, Egypt) **Photolysis of phoxim on glass and on tomato leaves.** *Bull. Environ. Contam. Toxicol.* 26(3): 413-419; 1981 (16 references).

Two experimental tomato plant plots were sprayed with phoxim at 2 kg (5% AI) 400 ℓ/acre. Leaf samples were collected after several time intervals. Phoxim was affected by heat and light, producing degradation products represented by 5 visible chromatographic spots. Phoxim photodegradation was faster when exposed to sunlight than when exposed to UV irradiation. The initial deposit, determined 1 hr after phoxim application, was 19 ppm. About 50% of the residues disappeared from leaf surfaces within 1 day after treatment. Phoxim residues disappeared at a slow rate and reached about 3% of the initial residues after 10 days. Minute amounts of phoxim could be detected in leaf extracts 1 and 2 days following phoxim spraying. These amounts represented only 0.5 to 1.5% of the initial surface residues. After 4 days all traces of residue in the leaf extracts had disappeared.

81-1863. Miyazaki, T.; Kaneko, S.; Horii, S.; Yamagishi, T. (Tokyo Metrop. Res. Lab. Public Health, Shinjuku-ku, Tokyo 160, Japan) **Identification of the synergist *bis*(2,3,3,3-tetrachloropropyl) ether in human milk.** *Bull. Environ. Contam. Toxicol.* 26(3): 420-423; 1981 (8 references).

Human milk samples were collected from several maternity hospitals in Tokyo from September to November of 1978 for monitoring of chlordane residues. Analysis revealed the presence of an unknown peak on the gas chromatogram. Mass spectral data confirmed the presence of several chlorine atoms in the compound. High resolution measurement of the base peak afforded elemental composition of $C_2H_4OCl_4$ which led to the assumption that the compound was a polychlorinated aliphatic ether. The compound was finally identified as *bis*-(2,3,3,3-tetrachloropropyl) ether (S-421). S-421 is used as a synergist for pyrethrin insecticides. The residual level of S-421 in pooled human milk was about 2 ppb on whole milk basis. It is not known whether this residual level in human milk would cause any functional damage to internal organs. Rat and rabbit LD50's for S-421 are low; 3.6 and 2.5 g/kg, respectively. The presence of S-421 residues in human milk may indicate previous exposure to insecticides.

81-1864. Cerna, V.; Pospisilova, J. (Inst. Hyg. Epidemiol., Prague Czechoslovakia) **Dynamika reziduipo osetreni mrkve metationem. [The dynamics of residues after treatment of carrot by Metation.]** *Cesk. Hyg.* 26(1): 9-16; 1981 (8 references) (Czech).

Carrots were treated with Metation (AI fenitrothion) and subsequent movement of fenitrothion and 3-methyl-4-nitrophenol were followed in carrots and soil. After application of a water emulsion of the pesticide, fenitrothion and 3-methyl-4-nitrophenol residues in leaves increased in relation to the applied dose. Large residues of fenitrothion and 3-methyl-4-nitrophenol were found in the first 5 cm of soil. Residues of fenitrothion were relatively low when compared to 3-methyl-4-nitrophenol, 0.13 *vs.* 0.23 mg/kg. In washed roots fenitrothion residues increased with the dose used. Most residues were found in the superficial layer. No residues were found in carrots after 14 days.

81-1865. Kuehl, D. W. (Environ. Res. Lab., US EPA, Duluth, MN 55804) **Unusual polyhalogenated chemical residues identified in fish tissue from the environment.** *Chemosphere* 10(3): 231-242; 1981 (86 references).

Findings of unique or unusual polyhalogenated xenobiotic chemicals identified in fish during environmental sampling studies conducted between 1970-80 are reported. The number of papers during this time in which new and unusual chemicals had been reported in fish was quite small. However, these reports did describe a wide variety of polychlorinated chemicals which originated from many sources, including the direct release of manufactured chemicals from industrial or agricultural activities such as Kepone (chlordecone), the indirect release of chemicals

such as toxaphene, the release of by-products of industrial processes, and the metabolism of environmental contaminants such as DDT to yield dichlorobenzophenone. Continued work in the area of chemical residue characterization is suggested.

81-1866. Thornton, I. (Appl. Geochem. Res. Group, Dep. Geol., Imp. Coll. Sci. & Technol., London, England) **Copper in soils and sediments.** In: *Copper in the Environment. Part I: Ecological Cycling*. Nriagu, J. O., ed. (John Wiley & Sons Inc.: NY): CH07: 172-216; 1979 (23 references).

Sources of copper in the environment included its use in fertilizers, ameliorants and pesticides. Copper sulfate is used for snail, mildew, potato blight and leaf spot control as well as a fertilizer. Copper applied in fungicides and fertilizers strongly binds to the upper soil layers and accounts for the copper content of many soils. The regional distribution and methods of mapping; the soil distribution; forms in soil; factors affecting the availability of copper to plants and the diagnosis of copper-deficient soils; soil-plant-animal relationships; relationships to other elements in soil; and copper residues in sediments are all reviewed.

81-1867. Gupta, U. C. (Res. Branch, Agric. Canada, Charlottetown, Prince Edward Island, Canada) **Copper in agricultural crops.** In: *Copper in the Environment. Part I: Ecological Cycling*. Nriagu, J. O. ed.(John Wiley & Sons Inc.: NY): CH09: 255-288; 1979 (164 references).

The beneficial and adverse functions of copper in plants, methods for determining copper in plants, the response of plants to copper and factors affecting plant uptake, deficient, sufficient and toxic copper levels in plants, and symptoms of copper toxicity and deficiency in crops are reviewed. Soil criteria useful in diagnosing copper status and copper-molybdenum- sulfur relationships in plants and animals as well as copper-containing fertilizers are also discussed.

81-1868. Gorder, G. W. (Iowa State Univ., Ames, IA) **Carbofuran persistence in soil and efficacy for corn rootworm larval control.** *Diss. Abstr. Int. B* 41(9): 3303-3304; 1981.

Carbofuran was effectively extracted from soil with either methanol:0.1 *N* HCl or ethyl acetate. The ethyl acetate procedure, used in most experiments, required gross soil-moisture adjustment, but was not influenced by soil type, pH, or carbofuran concentration. Extraction of whole samples was preferred over subsampling due to uneven carbofuran distribution within soil samples. Carbofuran in ethyl acetate extracts was determined, without extract concentration or cleanup, by a gas-liquid chromatograph (GLC) with a thermionic specific detector. Carbofuran in methanol:0.1 *N* HCl extracts was determined as its heptafluorobutyric derivative by GLC with an electron capture detector after solvent partitioning, cleanup, and concentration. Both laboratory and field tests showed that soil moisture was the most important factor influencing carbofuran persistence in soil. Degradation, that was apparently microbial, increased with increased soil moisture. Three of 4 soils tested at a high-moisture level degraded carbofuran to very low levels in just 10 days; persistence for 70 days is necessary for efficacy. Carbofuran phenol was probably the major metabolite. Laboratory studies showed that the leaching potential of carbofuran was reduced by the 10G formulation; leaching was not detected in the field. The formulated product degraded faster than the technical-grade carbofuran in high-moisture soil, suggesting that persistence could be improved by altering the formulation. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 8106014)

81-1869. Batterson, T. R. (Michigan State Univ., East Lansing, MI) **Arsenic in Lake Lansing, Michigan.** *Diss. Abstr. Int. B* 41(9): 3317; 1981.

Lake Lansing, MI, was treated with sodium arsenite for control of aquatic macrophytes in 1957. Two 2.5 m sediment cores from deep portions of the lake basin were analyzed for total As in 5 cm increments. Seventeen to 20 μg/g dry wt occurred in lower portions of the cores, and this was taken as background. Both cores had maxima of 330-340 μg/g at depth interval 0.15-0.30 m. These peaks were taken to represent contamination from weed treatment in 1957. The rate of decrease in recently deposited sediments predicted that concentrations near background would exist in surficial sediments in the deep portions of the basin by 1989. Samples (110) of the upper 7 cm of littoral sediments were taken along transects. Concentrations 2-6 times background occurred over 85-90% of the sediment surface. An arsenic mass balance budget was constructed for the lake for the interval June 1978 to June 1979. This showed that the lake lost more arsenic than it received annually. Internal loading of the water column from the sediments was occurring. A laboratory experiment was conducted to obtain predictions of arsenic expected in the lake as a result of interaction between contaminated sediments and the water column. Concentrations of arsenic observed in the lake fit expectations from the experimental work. Aerated littoral and epilimnetic water was found to be 5-25 μg total As/l. Concentrations on the order of 100 μg/l were observed in anaerobic hypolimnetic waters; however, concentrations that high were not the rule. Currents associated with summer storms periodically erode the metalimnion of this shallow lake. Except for infrequent summer periods, sulfide or ferric iron tend to limit total As in the hypolimnion to a concentration of 20-30 μg/l. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 8106466)

81-1870. Iverson, D. G. (Univ. Wisconsin, Madison, WI) **The role of demethylation reactions in the aquatic cycle of arsenic.** *Diss. Abstr. Int. B* 41(9): 3465; 1981.

Using analytical procedures developed to speciate the arsenic compounds arsenate, arsenite, monomethylarsonic acid (MMAA), and dimethylarsinic acid (DMAA), field studies and laboratory experiments were performed to examine degradation reactions of MMAA and DMAA in river waters and sediments. The methods were used to analyze river water and sediments in the Menominee River near Marinette, Wisconsin where residual MMAA in waste material from industrial production of arsenical herbicides has heavily contaminated the water and sediments. Total As concentrations in contaminated river water ranged from 0.02 mg/l to 1.6 mg/l. Sediment pore waters varied widely in arsenic concentrations from 0.5 mg/l to nearly 7000 mg/l with solid-phase arsenic levels up to 4000 mg/kg. Although MMAA was the most abundant arsenic species in most water and sediment samples, the presence of substantial inorganic arsenic in several samples suggested the possibility of chemical or biological demethylation of MMAA and DMAA. Laboratory experiments were performed to demonstrate that such reactions do occur in river waters and sediments at rates that depend on microbial activity, temperature, and concentration of methylated arsenic. In anaerobic sediments, MMAA and DMAA degraded to arsenite following pseudo first-order kinetics with rate constants ranging from 0.02 to 0.44/day. Rate constants were independent of the degree of arsenic methylation. Solid-phase MMAA and DMAA did not appear to participate in the reaction as much as expected, although there was some evidence of arsenite accumulation on the solids. In river water, MMAA degraded to arsenate, however, MMAA concentration-time data did not indicate any simple kinetic order. Instead, the reaction proceeded in a way that suggested microbial growth in the river water due to the demethylation of MMAA. These field and laboratory studies demonstrated the occurrence and the extent of microbial arsenic demethylation in an aquatic system. As a result, the role of these reactions appears to be comparable to other transformations presently established in the arsenic cycle, all of which influence the mobility, availability, and toxicity of arsenic in the environment. (Author abstract by permission. Copies of the thesis are available from University Microfilms, order No. 8011376)

81-1871. Gerike, P.; Fischer, W. K. (Dep. Ecol., Henkel KGaA, Duesseldorf, BRD) **A correlation study of biodegradability determinations with various chemicals in various tests. II. Additional results and conclusions.** *Ecotoxicol. Environ. Saf.* 5(1): 45-55; 1981 (20 references).

A variety of tests were conducted to correlate different methods of determining biodegradability of chemicals. A total of 44 chemicals, including the pesticide degradation products 2- and *o*-chloraniline, have been tested. Seven methods have already been tested and reported in previous papers. The present paper reports on 2 additional methods: the US EPA activated sludge test and a model trickling filter. In addition, trans-inoculation experiments were carried out; if a compound was degraded in one test but failed in another, the first was used as a preacclimation procedure for the second. Results from the various tests are compared in tabular form, and conclusions with regard to bioavailability testing requirements may be drawn. It is noted that 2-chloraniline was only highly eliminated in the Zahn-Wellens Test and the EPA activated sludge test, and all other results for this compound were negative.

81-1872. Kreiger, R. I.; Gee, S. J.; Lim, L. O. (Dep. Environ. Toxicol., Univ. California, Davis, CA 95616) **Marine bivalves, particularly mussels, *Mytilus* sp., for assessment of environmental quality.** *Ecotoxicol. Environ. Saf.* 5(1): 72-86; 1981 (42 references).

A review of the use of marine bivalves as environmental indicators is presented. Some marine bivalves, such as *Mytilus*, are excellent choices as indicators because they are widely distributed, dominant species. They are sessile filter feeders, which enable monitoring of heavy metals, radionuclides, and various hydrocarbons. It is suggested that whole body water content varies with stress. The antipyrine body water content indicator method is most useful for this type of analysis. Previous studies indicated that insecticides such as aldrin were not metabolized by mussels. However, more recent studies indicate that the bivalves are capable of oxidative metabolism. If this is the case, metabolism must be considered an important factor in studies on the effects of persistent compounds, such as chlorinated insecticides.

81-1873. Gaynor, J. D.; Volk, V. V. (Dep. Soil Sci., Oregon State Univ., Corvallis, OR 97331) **Runoff losses of atrazine and terbutryn from unlimed and limed soil.** *Environ. Sci. Technol.* 15(4): 440-443; 1981 (22 references).

Atrazine (2-chloro-4-(ethylamino) -6-(isopropylamino) -*s*-triazine) and terbutryn (2-(*tert*-butylamino) -4-(ethylamino) -6-(methylthio) -*s*-triazine) leaching and loss by surface runoff waters and sediment were measured under simulated rainfall conditions from unlimed and limed Peavine silt loam soil. Application of 7 cm of water produced 2-14% runoff water from the unlimed soil and little (1-3%) or no runoff from the limed soil. Sediment losses were low, averaging 16 kg/ha. Terbutryn was adsorbed by the soil (98%) to a greater extent than atrazine (60%); hence, the eroded sediments contained higher concentrations of terbutryn than atrazine. The amount of terbutryn and atrazine in the runoff water and sediment from simulated sample applied 12 hr after herbicide application was only 0.3 and 3.7%, respectively, of that applied. Of that amount, soil transport accounted for 1-3% of the *s*-triazine in the runoff.

Recoveries of atrazine and terbutryn were similar on unlimed and limed soil except for atrazine on unlimed soil. Atrazine recovered after 12 days was 25 and 74% of that applied to the unlimed and limed soil, respectively. (Author abstract reprinted by permission of the American Chemical Society)

81-1874. Welsenberg, E.; Ackerman, E.; Freier, S.; Reshef, A.; Sahm, Z.; Shoenberg, J. (Inst. Control & Standard. Drugs, Jerusalem, Israel) **Pesticides in the milk of mothers in Jerusalem.** *Excerpta Med. Int. Congr. Ser.* 518: 147-152; 1980 (9 references).

An investigation of the presence of α-HCH (BHC), γ-HCH (lindane), DDT and DDE residues in milk collected from women who had given birth in Jerusalem. Specimens were collected within 10 days after delivery and at 1 and 2 mo post-delivery. Samples were extracted and analyzed for the chlorinated hydrocarbons by gas-liquid chromatography. DDE was present in 98.6% of the samples; DDT was found in 60%; and HCH was detected in 83.5% of the samples. Levels of all pesticides in the milk decreased after 2 mo. Possible sources of contamination and results of previous studies from Jerusalem and other countries are discussed.

81-1875. Kalra, R. L.; Chawla, R. P. (Dep. Entomol., Punjab Agric. Univ., Ludhiana, India) **Occurrence of DDT and BHC residues in human milk in India.** *Experientia* 37(4): 404-405; 1981 (13 references).

This is the first report of DDT and BHC residues found in human milk samples collected in India. Samples were taken from 75 lactating women in Punjab India, during 1979, within 1 wk after delivery. DDT and BHC were present in all 75 samples. The ranges of concentrations were as follows: *p,p'*-DDE, 0.02-0.80 ppm; *p,p'*-DDT, 0.02-1.62 ppm; ΣDDT, 0.04-2.35 ppm; α-BHC, 0.002-0.160 ppm; β-BHC, 0.012-0.720 ppm; γ-BHC (lindane), mean = 0.007 ppm; and ΣBHC, 0.014-0.820 ppm. DDT, at an average level of 0.5 ppm, indicates an infant intake of 0.09 mg/kg/day, which is 18 times the acceptable daily intake recommended by the World Health Organization.

81-1876. Roots, O. O. (Estonian Inst. Thermophys. & Electrophys., Tallin, USSR) **Izuchenie transformatsii khlororganicheskikh pestitsidov v morskoi srede. [Transformation of organochlorine pesticides in the marine environment.]** *Gig. Sanit.* 46(3): 73-74; 1981 (6 references) (Russian).

To evaluate the degradation of organochlorine pesticides in the marine environment the metabolism of DDT was studied in sea water and hydrobionts of the Baltic sea. Degradation of α- and β-DDT (*o,p'*- and *p,p'*-DDT) in zooplankton and Baltic herring was 38-55% and 74-87%, respectively, compared with 15-23% and 50-68% degradation in sea water.

81-1877. Berck, B.; Iwata, Y.*; Gunther, F. A. (Dep. Entomol., Univ. California, Riverside, CA 92521) **Worker environment research: rapid field method for estimation of organophosphorus insecticide residues on citrus foliage and in grove soil.** *J. Agric. Food Chem.* 29(2): 209-216; 1981 (16 references).

Data for the development of a rapid field method for estimating levels of organophosphorus (OP) insecticide residues on agricultural crop foliage and in the dry mobile soil dust of groves and fields are reported. The field method for collecting foliage samples and removing the dislodgeable residues was patterned after the widely used Gunther laboratory method. The quantitative step is based on the reaction at 150°C for 3 min of OP residues with 4-(*p*-nitrobenzyl) pyridine which reacts with a broad spectrum of OP compounds. The method is adaptable to kit availability for use by competent nonchemists for use in testing fields to ensure that residues have declined to a toxicologically established safe level. The results obtained by using a prototype field kit are compared with results obtained by a laboratory method using samples collected after a field application of parathion, malathion, and methidathion to citrus trees. One person can, exclusive of sample collection time, conduct 6, 12, and 24 tests in 30, 50, and 90 min, respectively. (Author abstract reprinted by permission of the American Chemical Society)

81-1878. Khan, S. U.; Marriage, P. B.; Hamill, A. S. (Chem. & Biol. Res. Inst., Res. Branch, Agric. Canada, Ottawa, Ontario K1A 0C6, Canada) **Effects of atrazine treatment of a corn field using different application methods, times, and additives on the persistence of residues in soil and their uptake by oat plants.** *J. Agric. Food Chem.* 29(2): 216-219; 1981 (25 references).

Treatment of corn fields with the herbicide atrazine [2-chloro-4-(ethylamino) -6-(isopropylamino) -*s*-triazine] resulted in the formation of its 2-hydroxy analogue as the only measurable metabolite in a clay loam soil. The time and method of atrazine application (preplant incorporated, pre-emergence, and post-emergence) and the presence of oil-surfactant additives in the herbicide formulation had no long-term effect on its persistence. However, post-emergence application and the presence of additives resulted in a slightly greater initial degradation rate of atrazine in soil. Both atrazine, in less than phytotoxic amounts, and hydroxyatrazine persisted into the following growing season from all treatments. The residues from the field-treated soil were taken up, metabolized, and conjugated by oats seeded in the spring. (Author abstract reprinted by permission of the American Chemical Society)

81-1879. West, S. D.; Parka, S. J. (Agric. Res. Div., Lilly Res. Lab., Eli Lilly & Co., Greenfield, IN 46140) **Determination of the aquatic herbicide fluridone in water and hydrosoil: effect of application method on dissipation.** *J. Agric. Food Chem.* 29(2): 223-226; 1981 (8 references).

The rate of fluridone dissipation from the water and hydrosoil of 2 ponds following application of the aquatic herbicide by 2 different methods was found to be similar. The half-life of fluridone in water was 21 and 26 days following application to the surface of the water and along the bottom of the pond, respectively. The residue pattern of fluridone on the hydrosoil was also found to be similar in both ponds, with no detectable residue remaining 56 days after treatment. Residue determinations were accomplished by reverse-phase high-pressure LC with UV detection at 254 nm. Water samples were filtered and injected directly into the high-pressure LC or were extracted and concentrated prior to high-pressure LC analysis. Hydrosoil extracts were purified by XAD-2 and alumina column chromatography prior to high-pressure LC analysis. (Author abstract reprinted by permission of the American Chemical Society)

81-1880. Tanaka, F. S.; Wien, R. G.; Mansager, E. R. (Metab. & Radiat. Res. Lab., Agric. Res., SEA, USDA, Fargo, ND 58105) **Survey for surfactant effects on the photodegradation of herbicides in aqueous media.** *J. Agric. Food Chem.* 29(2): 227-230; 1981 (9 references).

The effects of 0.2% heterogeneous Tergitol TMN-10 and Triton X-100 on the photodegradation of herbicides were studied in aqueous solution. The phenylureas, carbamates, amides, and triazines (diuron, linuron, fluometuron, monuron, metobromuron, barban, chlorpropham, dichlormate, propham, PPG-124, propanil, alachlor, diphenamid, propachlor, atrazine, ametryne, and prometrone) were the 4 classes of herbicides examined. Compounds were selected to give a range of water solubilities for each class. A straightforward relationship between water solubility and surfactant effects was not observed. In the presence of surfactant under qualifying conditions, however, an increase in herbicidal photodegradation was observed as water solubilities decreased. Generally, herbicides having low water solubilities and a chloro substituent(s) on the aromatic ring other than 3,4-dichloro substitution showed this effect consistently. (Author abstract reprinted by permission of the American Chemical Society)

81-1881. Greenhalgh, R.; Belanger, A. (Chem. & Biol. Res. Inst., Agric. Canada, Ottawa, Ontario K1A 0C6, Canada) **Persistence and uptake of carbofuran in a humic mesisol and the effects of drying and storing soil samples on residue levels.** *J. Agric. Food Chem.* 29(2): 231-235; 1981 (23 references).

Four extraction procedures were evaluated for the recovery of carbofuran and 3-keto- and 3-hydroxycarbofuran from a fortified humic mesisol and a sandy loam soil. Aqueous HCl gave the lowest levels of coextractants, which interfered with quantitation of the intact compounds by a GC thermionic detector. Carbofuran was applied to a humic mesisol at 2.24 and 4.48 kg AI/ha in the field; the half-life of carbofuran was 15-38 days whether applied broadcast or banded. Both 3-hydroxycarbofuran and 3-ketocarbofuran were detected as transformation products, the former reaching maximum levels between days 1 and 7 and the latter between days 16 and 36. After 30 days, the carbofuran levels in soil previously treated with the insecticide were appreciably less than those treated for the first time. This was attributed to different induction times for the growth of carbofuran-degrading microorganisms in the soils. Carbofuran was taken up from the humic mesisol by crops; the levels were highest in onions and then lettuce and carrots for the banded application. Drying the soil samples at room temperature, 48 hr in the dark, resulted in a decrease of residues in the order carbofuran < 3-hydroxycarbofuran < 3-ketocarbofuran. Storage of both moist (150-180% water) and dried samples (9-11% water) for 6 mo at -20°C resulted in further reduction, especially for the moist samples. Under both storage and drying conditions, the order of loss is reflected in the chemical stability of the 3 compounds. It is postulated that degradation on cold storage resulted from soil enzyme activity. (Author abstract reprinted by permission of the American Chemical Society)

81-1882. Kaufman, D. D.; Russell, B. A.; Helling, C. S.; Kayser, A. J. (Pestic. Degrad. Lab., Agric. Environ. Qual. Inst., Beltsville Agric. Res. Cent., USDA, Beltsville, MD 20705) **Movement of cypermethrin, decamethrin, permethrin, and their degradation products in soil.** *J. Agric. Food Chem.* 29(2): 239-245; 1981 (18 references).

The movement of the synthetic pyrethroid insecticides decamethrin, cis and trans isomers of cypermethrin, and cis and trans isomers of permethrin and their degradation products DCVA [*cis,trans*-3-(2, 3-dichloroethyl) -2,2-dimethylcyclopropanecarboxylate] PBA (3-phenoxybenzyl alcohol), and PBA*c* (3-phenoxybenzoic acid) was examined in a Hagerstown silty clay, silty clay loam, and a Tifton loamy sand. Movement in both soil columns and soil thin-layer chromatographic (TLC) systems was compared. Decamethrin, *cis*- and *trans*-cypermethrin, and *cis*- and *trans*-permethrin were immobile in all soils. PBA1 was only slightly mobile in each of the 3 soils examined. Both DCVA and PBA*c* were mobile in each of the 3 soils examined, and the separation of the cis and trans isomers of DCVA was observed in some soils. Both DCVA and PBA*c* were less mobile in acid soils than in an alkaline soil. Soil TLC provided an exceptionally comparable picture of soil movement of the compounds examined when compared with the unsaturated soil columns. (Author abstract reprinted by permission of the American Chemical Society)

81-1883. Liu, S. Y.; Minard, R. D.; Bollag, J. M.* (Lab. Soil Microbiol., Dep. Agron., Pennsylvania State Univ., University Park, PA 16802) **Coupling reactions of 2,4-dichlorophenol with various anilines.** *J. Agric. Food Chem.* 29(2): 253-257; 1981 (14 references).

Cross-coupling between various aromatic compounds in the presence of an enzyme can lead to hybrid products. When a fungal phenol oxidase was incubated with 2,4-dichlorophenol (DCP) and various halogenated anilines, the formation of hybrid oligomers was determined. Mass spectrometric analysis indicated 2 types of trimers which consisted of a phenoxyquinone dimer coupled with an aniline molecule or a quinone coupled with 2 aniline molecules. Since the incubation of anilines alone with the fungal phenol oxidase did not cause the formation of oligomeric products, it was assumed that the coupling of aniline to enzymatic products of 2,4-dichlorophenol has to be of chemical origin. Quinone products from the enzyme reaction of 2,4-dichlorophenol were found to react with the anilines in the absence of phenol oxidase. This indicated clearly that both enzymatic and non-enzymatic causes were responsible for the formation of cross-coupling products. (Author abstract reprinted by permission of the American Chemical Society)

81-1884. Maitlen, J. C. (Yakima Agric. Res. Lab., Agric. Res., SEA, USDA, Yakima, WA 98902) **Gas-liquid chromatographic determination of residues of methiocarb and its toxic metabolites with the flame photometric detector after derivatization with methanesulfonyl chloride.** *J. Agric. Food Chem.* 29(2): 260-264; 1981 (12 references).

Residues of methiocarb, methiocarb sulfoxide, and methiocarb sulfone were determined by oxidation of the compounds to methiocarb sulfone, hydrolysis of the sulfone to its phenolic form, and then derivatization of the phenol to its mesylate with methanesulfonyl chloride. Residues of the methiocarb sulfone mesylate were then determined with a gas chromatograph equipped with a flame photometric detector operated in the sulfur mode. The procedure was applied to crops of spinach, celery, rhubarb, raspberries, and peas. Average residues in methiocarb-treated crops of spinach and celery were 3.67 and 0.43 ppm, respectively. No detectable residues were found in rhubarb, raspberries, or peas; the lower limit of detection was 0.05 ppm. (Author abstract reprinted by permission of the American Chemical Society)

81-1885. Feroz, M.; Kagan, J.; Ramesh, S.; Khan, M. A. Q.* (Dep. Biol. Sci., Univ. Illinois Chicago Circle, Chicago, IL 60680) **Photolysis of *cis*-chlordane: identification of two isomers of *cis*-photochlordane.** *J. Agric. Food Chem.* 29(2): 272-276; 1981 (9 references).

The insecticide *cis*-chlordane was photolyzed under UV light. The major photoreaction product, *cis*-photochlordane, was isolated and resolved into 2 isomeric forms. One of these products was a previously described (1,3,7,8,9,10,10-octachlorotetracyclo[5.2.1.$0^{2,6}$.$0^{4,9}$]decane), and the other was a new compound. The new photoproduct was analyzed by GC-MS, IR, and NMR spectrometry and tentatively assigned the chemical formula 1,3,4,7,8,9,10,10-octachlorotetracyclo[5.2.1.$0^{2,6}$.$0^{4,9}$]decane. The approximate ratio of the former to the latter was 3:1. (Author abstract reprinted by permission of the American Chemical Society)

81-1886. Doyle, R. C.; Kaufman, D. D.*; Burt, G. W.; Douglass, L. (Beltsville Agric. Res. Cent. West, Agric. Res. Serv., USDA, Beltsville, MD 20705) **Degradation of *cis*-permethrin in soil amended with sewage sludge or dairy manure.** *J. Agric. Food Chem.* 29(2): 412-414; 1981 (9 references).

The degradation of labeled [*carbonyl*-^{14}C]-*cis*-permethrin in sewage sludge and dairy manure amended Metapeake silt loam was investigated in the laboratory. Sewage sludge and dairy manure were applied to soil at rates of 0, 50, and 100 m ton/ha (t/ha), leached to remove soluble Salts, and incubated (30°C) for 14 days prior to pesticide application. [*carbonyl*-^{14}C]- *cis*-Permethrin was added at 1 ppm, and total CO_2 and $^{14}CO_2$ evolution was monitored regularly throughout a 60-day incubation period (25°C). ^{14}C-Labeled product distribution was determined by soil extraction and thin-layer chromatographic analysis at the end of the incubation. Incorporation of 50 or 100 t/ha sewage sludge or dairy manure increased permethrin breakdown 87 or 149%, or 64 or 134% above that measured in unamended soil, respectively. The pattern of $^{14}CO_2$ recovery indicated that microbial metabolism accounted for a significant percentage of permethrin breakdown in waste-amended soils after an extensive lag period. The rate of sludge or manure additions appeared to largely control the rate of microbially mediated permethrin degradation but had no apparent effect on chemical mechanisms of breakdown. In waste-amended soils a significant portion of the solvent-extracted ^{14}C was distributed in several relatively polar, unidentified compounds. (Author abstract reprinted by permission of the American Chemical Society)

81-1887. Edgerton, T. R. (Environ. Toxicol. Div., Health Effects Res. Lab., US EPA, Research Triangle Park, NC 27711) **Storage stability of chlorinated phenols in urine.** *J. Agric. Food Chem.* 29(2): 415-416; 1981 (11 references).

Chlorinated phenols are metabolites of various pesticides, and it is suggested that their determination in urine might be used as an index of pesticide exposure. The storage stability of chlorinated phenols in urine has been investigated. A decrease of greater than 40% was noted in urine fortified with known amounts of chlorophenols and analyzed over a 36-day period with repeated freezing and

thawing. A sample storage technique is presented which allows for the stability of chlorophenols in urine for up to 40 days with little or no decomposition noted. (Author abstract reprinted by permission of the American Chemical Society, modified)

81-1888. Sovocool, G. W.; Harless, R. L.; Bradway, D. E.; Wright, L. H.; Lores, E. M.; Feige, L. E. (Health Eff. Res. Lab., Environ. Toxicol. Div., US EPA, Research Triangle Park, NC 27711) **The recognition of diazinon, an organophosphorus pesticide, when found in samples in the form of decomposition products.** *J. Anal. Toxicol.* 5(2): 73-80; 1981 (33 references).

Analytical identification of decomposed samples of diazinon is described. Several samples of unknown organophosphate liquids were presented for quantitative analysis. However, quantification of the samples could not be performed until the compounds had been identified. Due to the presence of decomposition products, methods were devised for the identification of the samples before quantitative analysis was undertaken. Gas chromatography with phosphorus specific detectors indicated no intact pesticide was present. Mass spectrometry with low energy ionization techniques (field ionization, field desorption and chemical ionization) was then performed, and the resulting spectra were compared with library data. Tentative identification of the compounds as degradation products of diazinon led to confirmational analysis by GC/MS. Model decomposition experiments indicated several chemical compounds will be formed upon diazinon decomposition, and these compounds may be used as chemical markers of diazinon exposure.

81-1889. Akhya, T. K.; Sudhakar-Barik; Sethunathan, N. (Lab. Soil. Microbiol., Div. Soil Sci. & Microbiol., Cent. Rice Res. Inst., Cuttack, India) **Hydrolysis of selected organophosphorus insecticides by two bacteria isolated from flooded soil.** *J. Appl. Bacteriol.* 50(1): 167-172; 1981 (9 references).

Although microbial hydrolysis of parathion and related phosphorothioate insecticides with a common P-O-C linkage has been well demonstrated, not all phosphorothioates with a common P-O-C linkage were hydrolyzed with ease by a crude enzyme from a mixed bacterial culture. The hydrolysis of both diethyl (parathion and diazinon) and dimethyl (methyl parathion and fenitrothion) phosphorothioates by *Flavobacterium* sp. ATCC 27551 and *Pseudomonas* sp. ATCC 29353 was investigated. The *Flavobacterium* sp. hydrolyzed both the diethyl and the dimethyl phosphorothioates, while the *Pseudomonas* sp. hydrolyzed only the diethyl phosphorothioates. Glucose inhibited the hydrolysis of parathion by *Pseudomonas* sp., but not by *Flavobacterium* sp. The *Pseudomonas* sp. converted 4-nitrophenol to 4-aminophenol in the presence of glucose and to nitrite in its absence; 4-nitrophenol was not metabolized by the *Flavobacterium* sp. This study demonstrated the exceptional capacity of the *Flavobacterium* sp. to rapidly hydrolyze a variety of phosphorothioates with structural differences in their alkyl or ring portions. These bacteria may be particularly useful in the development of immobilized enzyme systems for the detoxification of pesticide wastes.

81-1890. Bowman, B. T. (Res. Inst., Agric. Canada, London, Ontario N6A 5B7, Canada) **Anomalies in the log Freundlich equation resulting in deviations in adsorption K values of pesticides and other organic compounds when the system of units is changed.** *J. Environ. Sci. Health B* 16(2): 113-123; 1981 (7 references).

The Freundlich equation K value is widely used to estimate the adsorption of pesticides by soil-water systems. Some anomalies in adsorption values created by the use of this equation are examined and precautions for using the K values to measure the relative adsorption of pesticidal compounds in soil-water environments are discussed. Dimensionless analysis of the Freundlich equation reveals that the units of K are not mol/g. When units are changed, the magnitude of K does not change by the same factor as the adsorption data from which it was calculated, except when the slope (N) equals 1. It was suggested that mole fraction (a unitless quantity) be used to express the equilibrium concentration, and that K should no longer be utilized as an indicator of relative adsorption. The effect of slope value on the magnitude of adsorption K value with changing units is illustrated for the adsorption of several organochlorine and organophosphorus insecticides on various soil-water systems. An alternate method of determining the relative adsorption of pesticides by soil-water systems is evaluated.

81-1891. Langston, W. J. (Lab. Mar. Biol. Assoc., Plymouth, England) **Arsenic in U.K. estuarine sediments and its availability to benthic organisms.** *J. Mar. Biol. Assoc. UK* 60(4): 869-881; 1980 (22 references).

Studies were conducted on the arsenic levels in estuarine sediments in the United Kingdom. Sediments and common species of benthic organisms were collected at 27 sites, and arsenic was determined by flameless atomic absorption. Iron and total organic carbon were also assessed to determine if they influence the distribution of arsenic. Arsenic levels ranged from 4 to 2500 μg/g in sediments, 11 to 160 μg/g in *Fucus*, 4 to 87 μg/g in *Nereis*, and 5 to 190 μg/g in *Scrobicularia*. The highest sediment levels were found in an area of mining activity. There was a strong correlation between iron and arsenic content of sediments. Arsenic in organisms was highest in areas with a high arsenic/iron ratio in the sediments. It is suggested that iron mediates the availability of arsenic to organisms in the sediments. The results of these studies indicate that the bivalve *Scrobicularia plana* is an excellent choice as an indicator species for the presence of arsenic.

81-1892. Pilenkova, I. I.; Popova, E. N.; Yurkova, R. G.; Degteva, A. I. (All-Union Res. Inst. Chem. Means Plant Prot., Ufa, USSR) **Ostatochyne kolichestva fungitsida EF-2 v pochve i rasteniyakh. [Residual amounts of fungicide EF-2 in soil and plants.]** *Khim. Sel'sk. Khoz.* 19(2): 51-52; 1981 (4 references) (Russian).

Persistence of the organochlorine fungicide EF-2 in soil and plants was studied. EF-2 has a low mammalian toxicity; the LC50 for rats is 1080 mg/kg. Residual amounts of EF-2 in the soil, seeds and shoots of wheat and oat were determined by gas-liquid chromatography. The sensitivity of the determination was 0.04 mg/kg. EF-2 was found to penetrate seeds and shoots. However, the fungicide was not detected in grain due to degradation. In the soil, EF-2 was found to degrade within one vegetative period.

81-1893. Heeschen, W.; Nijhuis, H.; Bleuthgen, A. (Inst. Hyg., Bunesanst. Milchforsch., Kiel, BRD) **Untersuchungen zur Bedutung des Um- und Abbaus von Hexachlorcyclohexan (HCH) im Milchtien und in der Umwelt fuer die HCH-Kontamination der Milch. [Investigations on the significance of the transformation and degradation of benzene hexachloride (BHC) in the lactating cow and in the surroundings for the BHC-contamination of milk.]** *Milchwissenschaft* 35(4):221-224; 1980 (8 references) (German).

Recent scientific studies support the contention that BHC may undergo isomerization, especially from γ-BHC (lindane) to α-BHC, due to the action of certain microorganisms. The stability of different BHC-isomers in lactating cows was examined with respect to the contamination of cows' milk. BHC degradation in rumen fluid was characterized by half-life periods of 12-100 hr. When rumen bacteria were incubated with BHC, little degradation of the pesticide was observed. No transformation of BHC isomers in soil was observed by conventional methods. However, long-term tests with radioactively-labeled lindane have revealed distinct transformations of γ-BHC to α-BHC.

81-1894. Watanabe, N.; Ishida, N.; Ishimaru, Y.; Katayama, Y.; Kitayama, S. (Kobe Commer. High Sch., Kobe, Hyogo, Japan) **[Pursuit of residues of organochlorine pesticides in freshwater fish, *Chaenogobius isaza* Tanaka.]** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 6(1): 31-36; 1981 (15 references) (Japanese).

Residues of BHC, DDT and *p*-nitrophenyl 2,4,6-trichlorophenyl ether (CNP) were measured in goby fish *(Chaenogobius isaza)* from Lake Biwa during the period 1966-76. The highest level of ΣBHC found was 2.09 ppm in 1970. BHC levels were reduced after the ban of BHC use; in 1976 0.55 ppm was detected. The highest level of ΣDDT was 0.89 ppm in 1967. Levels were reduced after the ban of DDT use; in 1976 0.16 ppm was found. The highest level of CNP found was 0.11 ppm in 1976; increased future levels are predicted. A significant correlation was found between application of BHC, DDT and CNP in Shiga Prefecture and levels found in fish. The ratios of β-BHC to ΣBHC and DDE to ΣDDT both showed a tendency of yearly increase.

81-1895. Varty, I. W. (Marit. For. Res. Cent., Fredericton, New Brunswick, Canada) **Ecological perspective in budworm management by chemicals.** *Proc. Symp. Aminocarb, 1978.* pp. 4-6; 1980.

Two main insecticides (aminocarb and fenitrothion) are employed in forest spraying to control budworm activities. While specifically aimed at mature and middle-aged stands of balsam fir and spruce, spray from these chemicals enters into and affects a variety of ecosystems with good natural balance. Surveillance methods are employed to check the effects of aminocarb, not only the immediate effects on target populations, but also on the short-term seasonal effects on the dynamics of the sprayed community and on the long-term effects which involve interplay of populations and repeated sprayings on a yearly basis. Vertebrates experience little or no lethalality from aminocarb and only mild transient sublethal effects. Macro-invertebrates possess a higher hazard rate, but generally, little direct mortality is noted. Monitoring must include biological control problems, litter decomposition, pollination, resource damage, and food chain concentration factors.

81-1896. Brown, H. L. (Author address not given) **Experience with aminocarb in Maine: efficacy and non-target effects.** *Proc. Symp. Aminocarb, 1978.* pp. 49-62; 1980.

Aminocarb was first applied in Maine in 1975 at 2.4 oz AI in 32 oz diesel fuel/acre (0.175 *l* AI in 2.3 *l*/ha). The test showed little efficacy in terms of controlling budworm and its damage; wind drift made it difficult to effectively evaluate the results. Additional testing was carried out over the next several years with the conclusion that aminocarb was equal to or perhaps somewhat superior to, the insecticides and dosages currently used in spruce budworm control operations in Maine. In some tests several types of organisms were monitored including birds, small mammals, fish, aquatic insects, flying insects, terrestrial insects, and soil micro-invertebrates for possible effects due to aminocarb spraying. At the same time series of residue samples covering foliage, soils, water, sediment, and fish tissues were collected and preserved for analysis. No obvious insecticide related changes were noted in bird populations. While no gross effects were noted in the aquatic fauna, there were some changes in treated streams that did not correspond to changes in the untreated streams.

81-1897. Waggoner, T. B. (Mobay Chem. Corp., Kansas City, KS) **Operational identification of metabolites of**

aminocarb. *Proc. Symp. Aminocarb, 1978.* pp. 86-102; 1980 (5 references).

Studies were performed to identify the major metabolite of aminocarb formed on foliage of sprayed plants. Ring-labeled ^{14}C-aminocarb was sprayed as a 1.4 OSC formulation in fuel oil to several 10-yr old Colorado blue spruce trees growing in the greenhouse in separate containers. Samples of foliage were collected periodically for 28 days after treatment. The major metabolite in the organosoluble fraction was identified as an intact carbamate and confirmed with an authentic standard as 4-(methylamino) -3-methylphenol methyl carbamate. Maximum residue levels of this metabolite occurred about 7 days after treatment. Throughout the study the metabolite level represented 1.8-2.4% of the level of aminocarb present. In soil studies, aminocarb was applied to sterilized soil and within 24 hr nearly 75% of the total ^{14}C activity remained bound to the soil after extraction. The major metabolite in the extractable fraction was also 4-(methylamino)-3-methylphenol methyl carbamate; it comprised 3-4% of the total residue in the soil during the first 24 hr but only traces thereafter. In water and sediment studies, sandy loam soil was flooded with water for 30 days. Fresh pond water was then exchanged and aminocarb was added to the surface of the water without mixing. Major metabolites occurred in the organosoluble fraction and were identified as 4-(methylamino) -3-methylphenol methyl carbamate and aminocarb phenol.

81-1898. Kingsbury, P. D.; McLead, B. B. (For. Pest Manage. Inst., Sault Ste. Marie, Ontario, Canada) **Studies on the environmental impact of aminocarb on aquatic and terrestrial forest ecosystems.** *Proc. Symp. Aminocarb, 1978.* pp. 105-117; 1980 (8 references).

Studies have been conducted from 1971 to 1978 on the effects of aminocarb on various non-target components of forest ecosystems such as aquatic fauna, forest songbirds, honey bees and small mammals. Few adverse short term effects have been noted and little disturbance to aquatic invertebrates in streams and lakes has been documented. Fish appear unaffected by conventional treatments. Territorial monitoring of songbirds has revealed no signs of mortality or disruption of nesting. Foraging honey bees have exhibited extensive but short lived mortality after late morning applications of 52 g aminocarb/ha. Overall effects on colony strength were not noticeable. No effects were noted on small mammal populations or breeding patterns.

81-1899. Plowright, R. C.; Pendrel, B. A. (Univ. Toronto, Toronto, Ontario, Canada) **A comparison of the effects of aminocarb and fenitrothion on forest pollinators in New Brunswick.** *Proc. Symp. Aminocarb, 1978.* pp. 118-124; 1980 (2 references).

Three years of studies on the effects of the spruce budworm spray program in New Brunswick on forest pollination are briefly reviewed. Initial results were for the insecticide fenitrothion, which showed extensive effects on wild bumble bee populations. The study method was designed to follow the chain of cause and effect from the initial toxicological impact of the insecticide on pollinating insects to their eventual effect on the population dynamics of insect-pollinated forest plants. With fenitrothion, significant mortality was found for bumble bees and solitary bees. In all cages directly under a spray pass, mortality was mover 80% for both types of bees. Aminocarb, at a dose of 0.07 kg/ha, appeared to have no direct effect upon survivorship of bumble bees in the exposure tests. In exposure tests of honey bees to aminocarb, a 28% mortality occurred. No effect of aminocarb was noted on the forest pollination system. Aminocarb is suggested as viable alternative to fenitrothion, in relation to pollinator species. The possibility of long-term changes in the population dynamics of insect-pollinated forest plants caused by this insecticide is still unresolved.

81-1900. Nazarov, S. S.; Zelepugin, A. D. (Agric. Inst., Voronezh, USSR) **Novye pestitsidy na svekle. [New pesticides for sugar beet crops.]** *Sakh. Svekla* (2): 39; 1981 (Russian).

The results of field trials of a series of pesticides on sugar beet crop are reported. The pesticides Baytex (fenthion), Dursban (chlorpyrifos), Ofunak (pyridaphenthion), Sumicidin (fenvalerate) and Ambush (aldicarb) showed rapid degradation. At harvest, soil and sugar beet plants did not contain pesticide residues.

81-1901. Knoppert, P. L. (N. V. Waterwinningsnedrijf Brabantse Biesbosch, Rotterdam, The Netherlands) **How to apply surface water storage from a health point of view.** *Sci. Total Environ.* 18: 263-284; 1981.

The use of reservoirs for surface water storage is described. The ways such a system can increase water quality are discussed. Surface water storage may be useful during periods of low river flow or periods during which direct use of surface water is impossible, such as the heavy concentration of pollutants. The use of proper design, installation and management can result in levelling the concentration of non-degradable substances, and lowering the level of degradable substances. Figures are given which indicate water quality improvement in reservoirs, including a decrease in lead and other metals, and a reduction in synthetic organic chemicals. Total organic chlorine pesticides measured 0.06 μg/l in the River Maas, 0.05 μg/l in Reservoir B, and 0.03 μg/l in Reservoir C.

81-1902. di Ferrante, E. (Comm. Eur. Communities, Brussels, Belgium) **Cooperative research on water quality**

and health parameters in the European community. *Sci. Total Environ.* 18: 301-306; 1981.

A program in which research projects on the relationship between water quality and health parameters are coordinated between the Federal Republic of Germany, France, Italy, The Netherlands, and the United Kingdom, is described. The titles of the projects carried out in each country are listed, along with the study areas, water sampling and analysis, population, and preliminary results. In Italy the metal content of drinking water and mortality due to coronary heart disease were studied in 10 towns. A positive correlation was found between mortality and Mg and Zn content of water. Organic micropollutants, including unspecified pesticides, were detected in water in France and The Netherlands.

81-1903. Crabbe, R. S.; Reid, J. D. (Natl. Aeronaut. Establ., Natl. Res. Counc. Canada, Ottawa, Ontario, Canada) **Results from two models for the long-distance drift and dry deposition of an insecticide cloud onto a forest.** In: *Second Joint Conference on Applications of Air Pollution Meteorology and Second Conference on Industrial Meteorology.* (Am. Meteorol. Soc.: Boston): pp. 285-291; 1980 (14 references).

A comparison of 2 models for long-distance drift of insecticides is presented. A hypothetical scenario is tested in which a cross wind line, 6 m above a spruce forest, is sprayed with a 12 m diameter spray cloud of fenitrothion. The Markov Chain Model, a kinematic description of droplet motion with inertia lag, and the Gradient Transfer Model, used for modelling the deposition of aerosol from repeated applications, are compared. The drift, up to 80 km from the spray area, was determined by each model. Good agreement between the 2 models was achieved for the first 500 m. However, at 80 km the Gradient Transfer Model predicted 21% still ariborne, and the Markov Chain Model predicted 12% still airborne. The reason for the discrepancy is not clear, but is reflected in the 20-25 μm diameter droplet size range. Although the difference between the model results is acceptable at the present time, more work needs to be conducted to improve the realism of the modelled source configuration, particularly an the influence of the aircraft's trailing vortices on effective source height.

81-1904. Guenzi, W. D.; Beard, W. E. (USDA, Fort Collins, CO 80522) **Degradation of *p*-chlorophenyl methyl sulfide, -sulfoxide, and -sulfone in soil.** *Soil Sci.* 131(3): 135-139; 1981 (5 references).

Persistence and effects on soil of pesticide degradation products were studied. Ascalon sandy loam, collected from a dryland wheat stubble field, was sampled to a depth of 15 cm, air-dried, ground to pass through a 2-mm sieve, and stored at 25°C for 3 mo. The soils were then amended with 0.5, 5 or 50 ppm of *p*-chlorophenyl methyl sulfide, *p*-chlorophenyl methyl sulfoxide or *p*-chlorophenyl methyl sulfone and incubated at field capacity at a constant temperature of 30°C. Production of carbon dioxide from the sulfide treatment was significantly greater than that from the sulfoxide and sulfone treatments. Concentrations of 0.5 and 5 ppm had no effect, but treatment with 50 ppm of each chemical significantly depressed carbon dioxide production during the 80-150 days of incubation. Recoveries of carbon from soil amended with sulfoxide and sulfone were not significantly different. However, carbon recovered from soil amended with sulfide was significantly lower than with the other 2 chemicals. The larger losses from the sulfide were probably due to sulfide volatilization during the initial 10 day incubation period.

81-1905. Menzer, R. E.; Nelson, J. O. (Univ. Maryland, College Park, MD) **Water and soil pollutants.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH25: 632-658; 1980 (94 references).

Sources of chemicals in the environment are discussed. The agricultural use of chemicals results in contamination of soil and water. Domestic and urban use and disposal of pesticides also contributes to environmental contamination. The transport, disposition and mobility of chemicals in the environment are also considered. Factors which interact to determine the movement and fate of chemicals in the environment include their water solubility, soil adsorption characteristics, vaporization, partitioning, bioaccumulation, degradation processes, and chemodynamics. A discussion of the major classes of pesticides is presented; they are grouped as persistent, moderately persistent, or non-persistent. The persistent pesticides include chlorinated hydrocarbon insecticides and cationic herbicides (paraquat and diquat). Triazine herbicides, phenylurea herbicides and substituted dinitroanilines are considered to be moderately persistent. Nonpersistent pesticides include phenoxy acid herbicides, phenylcarbamate and carbanilate herbicides, ethylenebisdithiocarbamate fungicides, and organophosphorus and carbamate insecticides.

81-1906. Wu, T. L. (Chesapeake Bay Cent. Environ. Stud., Smithsonian Inst., Edgewater, MD 21037) **Atrazine residues in estuarine water and the aerial deposition of atrazine into Rhode River, Maryland.** *Water Air Soil Pollut.* 15(2): 173-184; 1981 (34 references).

Water samples from the Rhode River, an estuary on the Chesapeake Bay, were analyzed for residues of atrazine twice weekly for a period of 2 yr. Dryfall, rainfall, and snowfall samples collected from December 1976 to February 1979 were also analyzed for atrazine residues by gas chromatography. Residues of atrazine were found in estuarine water and rainwater samples year-round. Atrazine levels in rainwater samples collected during the

winter were unusually high (3-970 ng/l). The highest levels of atrazine in rainfall occurred in May, and were attributed to the spraying of cornfields during this month. Levels of atrazine in estuarine receiving waters did not correspond to atrazine levels in rainfall. Although atrazine was enriched at the microsurface layer of estuarine water, direct atmospheric input of atrazine did not seem to be a contributing factor to this enrichment. The estuarine microsurface was suggested to be a source of atmospheric pollution, but the significance of this source has not yet been determined.

81-1907. Glooschenko, W. A.; Capocianco, J.; Coburn, J.; Glooschenko, V. (Ecol. Impact. Sect., Aquat. Ecol. Div., Natl. Water Res. Inst., Burlington, Ontario L7R 4A6, Canada) **Geochemical distribution of trace metals and organochlorine contaminants of a Lake Ontario shoreline marsh.** *Water Air Soil Pollut.* 15(2): 197-213; 1981 (32 references).

A sedimentary geochemistry study was conducted on the Lake Ontario shoreline as part of a water quality study of the suburban Rattray Marsh. The distribution of nutrients and potential trace metal and organochlorine pollutants in marsh sediments were studied with the aid of computer analysis. Sediment concentrations of Cu, Zn, Pb and Hg were generally higher than in local soils, but lower than those in recent sediments samples from Lake Ontario. About a 2-fold increase was observed in the sedimentary levels of Cu, Zn, Co, Cr, and Ni over the past 100 yr, while levels of Cd and Pb increased 4-fold and 8-fold, respectively. Factor analysis of geochemical data and higher metal levels in marsh areas subjected to sediment deposition suggested that the metals were most likely associated with silts and clays. Analysis of a suspended sediment sample from Sheridan Creek, the main tributary of the marsh, also indicated that the metals were transported in silts and clays. Organochlorine levels showed a distribution pattern similar to that of the trace elements. Major organochlorine contaminants present in surficial sediment samples included DDE, DDT, TDE, chlordane, PCB, mirex and hexachlorobenzene.

81-1908. Wegman, R. C. C.; De Korte, G. A. L. (Unit Residue Anal., Natl. Inst. Public Health, NL-3720 BA Bilthoven, The Netherlands) **Aromatic amines in surface waters of The Netherlands.** *Water Res.* 15(3): 391-394; 1981 (11 references).

A monitoring program was conducted to determine the presence of individual aromatic amines (herbicide transformation products) in samples taken from the Rhine River. Compounds identified included aniline, 2-chloroaniline, 3-chloroaniline, 4-chloroaniline, 2,3-dichloroaniline, 2,5-dichloroaniline, 2,4-dichloroaniline, 2,6-dichloroaniline, 3,4-dichloroaniline, 3,5-dichloroaniline, 2-methylaniline and 4-methylaniline. In 1979, aniline, 2-, 3-, and 4-chloroaniline, 3,4-dichloroaniline and 4-methylaniline had a frequency of occurrence of over 50% in samples from the Rhine River at Lobith. 2,6-Dichloroaniline was never detected. In the Boven Merwede River, a tributary of the Rhine River, the median values for aniline, 2-chloroaniline and 3,4-dichloroaniline were higher than in the Rhine River itself. In the Meuse River at Eijsden, only the median values for aniline and 3,4-dichloroaniline were above the detection limits. In the Meuse River at Lith, aniline, dichloroaniline and 2-, 3-, and 4-chloroaniline were detected frequently, but in low concentrations. It was concluded that the sources of the aromatic amines were located between Monheim and Duisburg-Ruhrort in the Federal Republic of Germany and between Loevestein and Ablasserdam in The Netherlands. The highest concentration was found in the river at Neuss-Dusseldorf.

81-1909. van der Veen, C.; Huizenga, J. (Amsterdam Water Works, NL-1014 AX Amsterdam, The Netherlands) **Combatting river pollution taking the Rhine as an example.** *Water Sci. Technol.* 13(2): 1035-1059; 1981 (18 references)

Some of the problems of river pollution, and attempts to combat these problems, are discussed; the Rhine River is used as an example. Physical characteristics, loading parameters, and various uses of Rhine water are described. The oxygen concentration constantly dropped from 1946 to 1971, but has since increased. Data collected in 1978 from the lower course of the Rhine show chemical oxygen demand to be 13 mg/l; hydrocarbons, 0.14 mg/l; lipophile, sparingly volatile organic chlorine compounds, 0.021 mg/l Cl; organic pesticides (total), 0.00006 mg/l Cl; organic chlorine pesticides (individual substance), 0.00004 mg/l Cl; and cholinesterase inhibitors as parathion equivalents, 0.0009 mg/l. The first four figures exceed the IAWR limiting values. In addition, recent studies of trout stock indicate that the Rhine water is chronically toxic to this fish species. The water quality management of the Rhine, on an international basis, is described in detail. As part of this program, substances considered to be dangerous and which must be dealt with are listed; this list includes dieldrin, aldrin, endrin, chlordane, heptachlor, heptachlor epoxide, hexachlorobenzene, hexachlorocyclohexane (BHC), DDT, PCBs, pentachlorophenol (PCP), hexachlorobutadiene and endosulfan.

81-1910. Menges, R. M.; Tamez, S. (Subtrop. Fruit & Veg. Res., Agric. Res., SEA, USDA, Weslaco, TX 78596) **Response of cucumber *(Cucumis sativus)* to annual weeds and herbicides.** *Weed Sci.* 29(2): 200-208; 1981 (25 references).

Weed and cucumber (*Cucumis sativus* L. Poinsett) growth was studied where herbicides were soil-applied or applied to emerged weeds in the established crop. Cucumber yields were decreased at least 36% in 2 of 5 yr

when weeds interfered for 4 wk after emergence. Sequential applications of bensulide [*O,O*-diisopropyl phosphorodithioate *S*-ester with *N*-(2-mercaptoethyl) benzenesulfonamide] applied pre-plant and incorporated (PPI) + trifluralin (α,α,α-trifluoro 2,6-dinitro-*N,N*-dipropyl-*p*-toluidine) applied post-emergence and incorporated (POI) were outstanding and controlled Japanese millet (*Echinochloa crus-galli* Link. var *Frumentacea*), Texas panicum (*Panicum texanum* Buckl.), Palmer amaranth (*Amaranthus palmeri* S. Wats.), and common purslane (*Portulaca oleracea* L.) without affecting the growth or yield of cucumber. Compared with bensulide, the selectively of soil-incorporated butralin [4-(1,1-dimethylethyl) -*N*-(1-methylpropyl) 2,6-dinitrobenzenamine] with cucumber was limited. Laboratory bioassays showed that under warm field soil conditions, PPI applications of 1.7 kg/ha butralin persisted more than 2 mo, but were dissipated after 4 mo. Ethalfluralin [*N*-ethyl-*N*-(2-methyl-2-propenyl) 2,6-dinitro-4-(trifluoromethyl) benzenamine] reduced cucumber yields only when it was soil-incorporated to the crop-seed depth at planting. Applications to soil of bensulide + DCPA (dimethyltetrachloroteraphthalate) stunted cucumber plants, reduced leaf area, increased leaf thickness, and caused higher near-infrared (0.75-1.34 μm) leaf reflectance. (Author abstract by permission)

See also 81-1801, 81-1811, 81-1813, 81-1816, 81-1833, 81-1840, 81-1842, 81-1851, 81-1915, 81-1919, 81-1920, 81-1922, 81-1924, 81-1925, 81-1927, 81-1932, 81-1935, 81-1938, 81-1946, 81-1976, 81-1981, 81-2007, 81-2011, 81-2065, 81-2067, 81-2070, 81-2071, 81-2072, 81-2076, 81-2077, 81-2081, 81-2082, 81-2084, 81-2095 *and* 81-2096.

81-1911. Rappe, C.; Buser, H. R. (Dep. Org. Chem., Univ. Umea, S-90187 Umea, Sweden) **Occupational exposure to polychlorinated dioxins and dibenzofurans.** *ACS Symp. Ser.* 149: 319-342; 1981 (61 references).

The toxicity and metabolism of various polychlorinated dioxins and dibenzofurans (PCDDs and PCDFs) are discussed. The isomers with the highest acute toxicity have their 4 lateral positions substituted for chlorine, and have LD50 values in the range of 1-100 μg/kg for the most sensitive animal species. These same isomers have been reported to have the highest biological potency. Detection levels for these extremely toxic substances should be well below the usual detection limits obtained in pesticide analysis. The occurrence of specific chemicals in the industrial workplace is discussed for phenoxy acids such as 2,4,5-T and TCDD, hexachlorophene, chlorophenols, and PCBs (Aroclor 1260, phenoclor DP-6, and clophen A-60). Human exposure may arise through specific exposure, mainly of occupational origin, or due to a general, public exposure. Several conclusions have been drawn from monitoring workers exposed to these chemicals. PCDDs and PCDFs can be detected in blood of exposure workers; total levels may be as high as 400 pg/g of blood plasma. These chemicals were found at similar levels in blood after a 6-8 mo period of non-exposure. Levels of chlorophenols in the urine increased up to 100 times after exposure, indicating a lack of correlation between blood and urine analyses. For evaluation of exposure to chlorophenols, analysis of PCDDs and PCDFs in blood is recommended over measurement of chlorophenol levels in urine.

81-1912. Ter Haar, G. (Toxicol. Ind. Hyg., Ethyl Corp., Baton Rouge, LA 70801) **An investigation of possible sterility and health effects from exposure to ethylene dibromide.** *Banbury Report* 5: 167-188; 1980 (20 references).

Studies are reviewed on the health effects of ethylene dibromide (EDB), which is used primarily as a lead scavenger in gasoline and as a pesticide. In studies on EDB levels in air, ambient levels have been found to range from 0.00001 to 0.00005 ppm. Worker exposure during fumigation can range from not detectable to 0.08 ppm. Studies on acute and chronic effects of EBD are summarized. In one study of 53 workers exposed occupationally to EDB for 3 mo-10 yr, only one death was recorded; the cause was listed as cancer of the kidney. This was not found to be an abnormal mortality experience. Studies on possible fertility effects of EDB are also cited. The studies do not indicate any decreased sperm count or decreased numbers of children which could be attributed to EDB.

81-1913. Gold, L. S. (Dep. Biochem., Univ. California, Berkeley, CA 94720) **Human exposures to ethylene dichloride.** *Banbury Report* 5: 209-225; 1980 (43 references).

A report is presented in which the exposure of humans to EDC is discussed. Two million lb/yr (7.46×10^5 kg/yr) are used as pesticides; this is a small percentage of the total industrial usage. An estimated 1,596,300 workers are exposed to EDC, the largest numbers being service station employees. The current OSHA standard for exposure is 50 ppm, as an 8-hr time-weighted average, based on effects other than cancer. Exposure to EDC from food varies with food types, but is generally regarded as a minor source. The use of TCE in pesticides, mainly fumigants, leads to further exposure. Chronic, low-dose exposure results from the contamination of air and water. Levels of 1-2 ppb were found in 53 of 204 water samples taken near industrialized sites in the United States. It is estimated that 12.5 million people are exposed to average annual EDC concentrations of 0.01-10 ppb. The EPA is currently involved in the limiting of exposure to EDC.

81-1914. Johnson, M. N. (B.F. Goodrich Co., Akron, OH 44318) **Medical aspects of ethylene dichloride in the workplace.** *Banbury Report* 5: 257-263; 1980.

A discussion is presented of the value of periodic health examinations of workers exposed to EDC and other chemicals. It is noted that there are many types of diseases that cannot be diagnosed by regular checkups; however, it has been shown to be worthwhile for chemical workers to obtain periodic examinations. The levels of organophosphorus exposure can be easily determined by cholinesterase activity. Poisoning by other types of toxins, such as vinly chloride, are not so easily detected. Important follow-ups of routine examinations include good record keeping, informing workers of examination results, and educating workers to protect themselves from exposure.

81-1915. Kellam, R. G.; Dusetzina, M. G. (Off. Air Qual. Plann. & Stand., US EPA Research Triangle Park, NC 27711) **Human exposure to ethylene dichloride: potential for regulation via EPA's proposed airborne carcinogen policy.** *Banbury Report* 5: 265-276; 1980 (7 references).

A discussion of various aspects of the US EPA's proposed airborne carcinogen policy with regard to ethylene dichloride (EDC) is presented. The EPA has performed a preliminary assessment of human exposure to EDC in the atmosphere. The mean concentrations of 3 sampling locations (all near producing facilities) ranged from not detectable to 15 ppb. As expected, the highest concentrations were detected closest to the EDC producing facilities. This compound is a hazardous air pollutant, and it is suggested that significant sources should be required to install best available technology (BAT) or implement more stringent methods to reduce emissions.

81-1916. Eriksson, M.; Hardell, L.; Berg, N. O.; Moeller, T.; Axelson, O. (Oncol. Dep., Univ. Hosp.,

Umea, Sweden) **Soft-tissue sarcomas and exposure to chemical substances: a case-referent study.** *Br. J. Ind. Med.* 38(1): 27-33; 1981 (30 references).

An investigation was performed in Southern Sweden to determine the potential effects of MCPA, 2,4-D, and the analogous phenoxy-propionic acids, all of which are widely used in the agricultural areas of southern Sweden. Included in the study were 330 patients with soft-tissue sarcomas. Of these 330 cases, exposure to phenoxy acids or chlorophenols was reported by 25 (22.7%). The risk ratio for soft-tissue sarcomas after exposure to phenoxy acids or chlorophenols was 5.1 in the matched material. Exposure to chlorophenols resulted in a risk ratio of 3.3. Low-grade exposure was present among 7.3% of the cases, and was not interpreted as creating a hazard. It was concluded that exposure to phenoxy acids and chlorophenols may constitute a risk factor in the development of soft tissue sarcomas.

81-1917. Meller, D.; Fraser, I.; Kryger, M. (Dep. Respir. Med., St. Boniface Hosp., Univ. Manitoba, Winnipeg, Manitoba R2H 2A6, Canada) **Hyperglycemia in anticholinesterase poisoning.** *Can. Med. Assoc. J.* 124(6): 745, 746, 748; 1981 (6 references).

A woman and her son presented with coma, miosis, metabolic acidosis, and hyperglycemia. Two other family members suffered nausea, vomiting, salivation, diaphoresis and muscle twitching. Subsequent investigation suggested malathion poisoning. A dog and cat were found dead on the family property, but the bodies were not available for examination. Public health authorities inquired of neighbors and found that a farmer's field adjacent to this family's property had been sprayed with malathion shortly before the family's symptoms began. Efforts to detect malathion on vegetables from the family garden were not successful due to a significant amount of rainfall. The hypoglycemia effect exhibited in the reported case was attributed to increased insulin secretion secondary to direct or indirect effects of cholinergic stimulation. Hyperamylasemia was present in the acutely intoxicated patients. Whether this finding is a manifestation of the response to initial hypoglycemia or the result of severe necrotizing pancreatitis is not clear. It is concluded that the presence of nonketotic hyperglycemia coma with metabolic acidosis should suggest organophosphate intoxication in addition to diabetes mellitus.

81-1918. Anonymous **Herbicide 2,4,5-T could escape ban.** *Chem. Eng. News* 59(16): 8; 1981.

The American Council on Science and Health has found the available scientific evidence insufficient to support a ban on the use of 2,4,5-T. Evidence suggests that the EPA is now willing to negotiate a settlement with manufacturers of the compound. Concern centers around the wording of the more restrictive labeling proposed by EPA for 2,4,5-T containers. It is concluded that no relationship between the traditional use of the herbicide and adverse health effects on humans has been proven; however, there is strong evidence that use of the chemical should be regulated.

81-1919. Anonymous **Bacteria may be used to degrade pollutants.** *Chem. Eng. News* 59(16): 8; 1981.

Studies involving the degradation of persistent pollutants by microorganisms are reported. Microorganisms obtained from chemical waste dump sites are grown in fermentors along with other microorganisms chosen because they carry plasmids enabling them to resist certain chlorine-containing antibiotics. Pressure is applied to the microorganisms to induce development of new ways of degrading pollutants. The bacteria are grown over long periods of time and their carbon source is gradually shifted from an antibiotic to 2,4,5-T. In some experiments > 70% degradation of 2,4,5-T was effected in 1 wk.

81-1920. Anonymous **UV light, bacteria destroy toxic wastes.** *Chem. Eng. News* 59(16): 35-36; 1981.

Experiments using ultraviolet light and soil microorganisms to decompose several chlorinated hydrocarbons are reported. Among those chemicals tested for decomposition by these agents was the herbicide 2,4,5-T. The method will also work (less efficiently) on the contaminant of 2,4,5-T, 2,3,7,8-tetrachlorodibenzo- *p*-dioxin (TCDD). Solutions of the chemicals are irridated with UV light for 1 hr while oxygen is bubbled through the solution. Treated solutions are then poured over soil samples containing normal colonies of bacteria. After 1 mo of treatment a solution of 2,4,5-T was > 80% decomposed.

81-1921. Anonymous **New EPA head may fix the future of 2,4,5-T.** *Chem. Week* 128(16): 13; 1981.

A discussion is presented of factors involved in reaching a decision regarding the use of 2,4,5-T in the United States. Political considerations, including the philosophy of the new EPA head, and data on the effects of 2,4,5-T, are considered. The American Council on Science and Health recently released a report which states that there is no scientific evidence to indicate a relationship between the traditional domestic use of 2,4,5-T and illness in humans. The Agent Orange issue was not addressed in this report due to insufficient information on the amount of 2,4,5-T to which servicemen were exposed. No evidence was found to indicate that 2,4,5-T causes birth defects or miscarriages when properly used. However, it is noted that the Council does recognize problems caused by dioxin, an unavoidable contaminant of 2,4,5-T.

81-1922. Guzman-Harty, M.; Bianchine, J.; Singell, J. (Sch. Med., Ohio State Univ., Columbus, OH) **Effect of low-level organophosphate exposure on cholinesterase activities in lawn applicators.** *Clin. Pharmacol. Ther.* 29(3): 250; 1981.

Blood enzyme activities were measured every 2 wk in lawn-spray applicators exposed to cholinesterase (ChE) inhibitors. The Michel assay was employed. The enzyme activity of the majority of applicators dropped 30-50% during the heavy insecticide spraying season of June-August. Plasma ChE reduction to < 30% activity did not significantly affect red cell acetylcholinesterase, which acted as a safety reservoir for acetylcholine buildup. At this level of reduction the workers were removed from the direct contact situation. Organophosphate effects on the enzyme activity were reversible within 1 mo. It is concluded that establishment of a systematic biomonitoring program minimized exposure risk considerably.

81-1923. Hardie, R. A.; Rajan, V. S. (Middle Rd. Hosp., Republic of Singapore) **A survey of orchid growers.** *Contact Dermatitis* 7(2): 122-123; 1981 (1 reference).

A limited survey for contact dermatitis among 53 orchid cultivators in Singapore was performed. Hand dermatitis was of particular interest. Short-lived outbreaks of hand dermatitis were noted to occur after the introduction of new fungicides and insecticides. These outbreaks subsided when use of the agents was discontinued. Among the five firms surveyed, several insecticides and fungicides were associated with the contact dermatitis. It was not possible to correlate the disease with use of a single chemical. It was concluded that contact sensitivity to orchids is rare.

81-1924. Cohen, S. R. (Dep. Dermatol., Sch. Med., Yale Univ., New Haven, CT) **Environmental and occupational exposure to copper.** In: *Copper in the Environment. Part II: Health Effects.* Nriagu, J. O., ed. (John Wiley & Sons Inc: NY): CH01: 1-16; 1979 (54 references).

Sources of copper in the environment include insecticides such as copper sulfate and copper naphthenate, algicides such as copper pentachlorophenate and copper dimethylgloxime, and molluscicides. Occupational exposure to copper can occur through the manufacture of these compounds or their subsequent handling and storing. Vineyard sprayer's lung, a respiratory disease, has been reported among Portuguese workers handling fungicides containing 1-2% solutions of copper sulfate. Spraying was carried out 15 to 100 days of the year, and 600 *l* of the solution were sprayed each day by each worker. The workers developed interstitial pulmonary lesions, including histiocytic granulomas and associated nodular, fibrohyaline scars. Abundant copper deposits were found in these scars. Lung cancer may develop and the high incidence of adenocarcinoma and alveolar cell carcinoma suggests this is an occupationally related cancer. Effects of copper salts on the gastrointestinal tract and the effects on the hematologic, renal, cardiovascular, and neurologic systems from ingestion are also reviewed.

81-1925. Netzer, A.; Beszedits, S. (Environ. Sci., Univ. Texas, Richardson, TX) **Removal of copper from wastewaters.** In: *Copper in the Environment. Part I: Ecological Cycling.* Nriagu, J. O. ed. (John Wiley & Sons Inc.: NY): CH06: 124-169; 1979 (87 references).

Copper pollution in the environment occurs from many sources, among them being the wastewaters arising from the use of certain wood preservatives which contain copper. Copper was found to vary from 0.05 to 1.1 mg/l in the discharge of a wood-preserving plant employing water-based preservatives. Various techniques are available for removing copper from wastewaters. Biological treatment methods, particularly activated sludge processes, are widely used in the treatment of municipal and industrial wastewaters. Copper present in the waters of such treatment systems at concentrations from 0.4 to 25 mg/l can reduce the efficiency by up to 7%. Chemical precipitation is the most popular technique for removing inorganic heavy metals. Reverse osmosis may be used either by itself or to supplement other methods. Ion exchange is particularly effective for removing heavy metals from wastewaters. Electrodialysis, electrolytic processes, evaporative recovery, solvent extraction, the liquid membrane method, free crystallization, ozonation, cementation, silicon alloys, activated carbon adsorption, and synthetic polymeric adsorbents are each discussed as they are used in the removal of copper from wastewaters.

81-1926. Erhardt, H. P.; Zinsser, E.; Bartsch, R.; Bretschneider, M. (Inst. Arbeitshyg., DDR-6900 Jena, DDR) **Leberbioptische verlaufskontrolle und arbeitsmedizinische konsequenzen bei werktatigen in pflanzenschutz und schadlingsbekampfung. [Liver biopsy checkups and medical consequences of working daily in plant protection and pest control.]** *Dtsche. Gesundheitwes.* 36(6): 265-268; 1981 (17 references).

A study of 41 plant protection and pest control workers is reported. Liver biopsies were performed on the workers, and 2 yr later were repeated in 27 of the 41 subjects. No significant histological differences were found between the 2 biopsies, and no uniform pattern was revealed in the trends of the individual findings. However, statistical analysis of the data revealed improvement in those workers who transferred to a new occupation and reduced their alcohol intake and body wt. The histological findings were aggravated in that group in which alcohol intake and body wt were decreased or remained the same, but in which changes of occupation were less frequent.

81-1927. Anonymous **Pollution topics.** *Environ. Health* 89(3): 72-73; 1981.

The need for a balance between economy and ecology is discussed. Specific reference is made to a paper published by the United Kingdom Department of the Environment in their Work Management series (HMSO) on the subject of pesticide waste. Useful information on all aspects of disposal, including incineration and open burning, is included. Incineration is mainly used for organic pesticide wastes not acceptable for disposal on land. Incineration temperatures > 1000°C are advisable, for incineration within 2 sec, in most cases where organochlorines are present. Gas cleaning apparatus is usually provided to remove acid gas products of combustion and particulates. Metal fumes from the inorganic or organometallic pesticides are very difficult to remove. Incinerators for these purposes must be licensed under provisions of the Control of Pollution Act of 1974. Small quantities of most organic pesticides can be destroyed safely in controlled, supervised bonfire burning at a site remote from human habitation. Bonfires may also be used to decontaminate open metal containers prior to subsequent disposal.

81-1928. Medved', L. I.; Tkach, L. I.; Baida, L. K. (All-Union Res. Inst. Hyg. Toxicol. Pestic. Polym. & Plast., Kiev, USSR) **Metodicheskie podkhody k izucheniyu vliyaniya intensivnogo primeneniya pestitsidov na zdorov'e detei, proshivayushchikh v sel'skoi mestnosti. [Methodological aspects of the study of the effect of intensive use of pesticides on the health of children in rural areas.]** *Gig. Sanit.* 46(2): 12-14; 1981 (5 references) (Russian).

The results of a series of investigations on the effect of intensive use of pesticides on the health of children in rural areas are reported. Retrospective analysis of epidemiological data, the results of repeated physical examinations, cohort analysis of the morbidity, physiological development and non-specific indices of functional state showed significant effect of pesticides on morbidity indices.

81-1929. Majeti, V. A.; Clark, C. S. (Dep. Environ. Health, Univ. Cincinnati, Cincinnati, OH) **Health risks of organics in land application.** *J. Environ. Eng. Div. Am. Soc. Civ. Eng.* 107(2): 339-357; 1981 (69 references).

Long term health risks associated with exposure to organics in wastewater treatment plants or at land application sites are discussed. While acute toxic effects are easily recognizable, there are not enough data available to effectively evaluate long range effects. The uptake of organic chemicals by food crops, the extent of ground-water pollution by organic chemicals leaching from landfills or sludge applied lands, pertinent chronic human health effects from the agricultural use of and occupational exposure to pesticides, long-term follow-up on populations with acute short-term exposure to organic chemicals from waste materials, and potential health effects of using domestic sewage sludge as a cattle feed supplement for both beef and dairy cattle, are considered to be areas requiring further study.

81-1930. Woolson, E. A. (Pestic. Degradat. Lab., Agric. Res., SEA, USDA, Beltsville, MD 20705) **Formation of arsenite in lead arsenate or calcium arsenate mixtures.** *J. Environ. Sci. Health B* 16(2): 131-140; 1981 (15 references).

Adverse health effects have been reported in workers involved in the production, packaging, and use of lead and calcium arsenate pesticides. The formation of arsenite has been observed when lead or calcium arsenate were mixed with lime, lime sulfur, sulfur or casein. The reduction of arsenate increased with time after dry mixing of these formulations. Concentrations of soluble arsenite decreased in aqueous solutions after 24 hr, but increased again after 2 mo. Levels of total arsenite ranged from 0.6 to 2.4% of the arsenic present 253 days after formulation.

81-1931. Klimek, K.; Gregorczyk, J.; Chrzanowska-Ansilewska, K.; Millo, B. (Inst. Intern. Dis., Med. Acad. Szczecin, PL-70111 Szczecin, Poland) **Zachowanie sie aktywnosci niektorych enzymow proby BSP oraz frakcji bialkowych surowicy krwi u pracownikow zakladu dezynfekcji, dezynsekcji i deratyzaciji. [The activity of some enzymes, BSP tests and blood serum protein fraction in the workers of a disinfection, insect control and rodent control plant.]** *Med. Pr.* 31(6): 459-467; 1980 (8 references) (Polish).

Forty-two workers involved in disinfection, insect control and rodent control were tested to determine toxic effects of occupational exposure to toxic compounds. Workers of both sexes and of various ages had differing lengths of service and degrees of exposure. Toxicity was due to the possibility of inhalation, and dermal and gastric absorption. Serum activities of AspAT, AlaAT, LDH, GLDH, AP and ChE were monitored. BSP retention, protein level and its electrophoretic division were determined. Workers involved in DDD (TDE) activities showed increased enzyme activities, particularly LDH and GLDH. Values for workers exposed to a larger number of toxic compounds and longer service were highest. A decrease was found in cholinesterase (ChE) of the serum of tested workers. An increase in BSP retention was found in workers with greater exposure to toxic compounds. The results obtained indicate damage to some organs, particularly the liver (liver parenchyma lesion). This is confirmed by clinical observations in industry.

81-1932. Mito, K.; Hayashi, Y.; Dallimunthe, D.; Tsubota, M.; Hara, H.; Kawate, K.; Nishimoto, Y.;

Takashina, S. (Sch. Intern. Med. II, Fac. Med., Hiroshima Univ., Hiroshima, Japan) **[Studies on the effects of agricultural chemicals on workers engaging in greenhouse culture.]** *Nippon Noson Igakkai Zasshi (J. Jpn. Assoc. Rural Med.)* 29(6): 828-832; 1981 (6 references) (Japanese).

Results of physical examinations of 74 green-house workers (35 men and 39 women) in Hiroshima Prefecture were compared to the results of examination of field workers. The agricultural chemicals used by both groups were diazinon, Estox (Metasystox S), malathion, fenitrothion, paraquat, chlorothalonil and maneb. Physical examination included measurement of blood pressure, protein and occult blood in urine, occult blood in feces, electrocardiogram and hematological items. Significant differences were observed between green-house and field workers in cholinesterase activity. Activities for green-house workers were 0.91, 0.75 and 0.77 (Δ pH) in 1977, 1978 and 1979 respectively. Field workers exhibited 0.99, 0.87 and 0.87 (Δ pH) in 1977, 1978 and 1979, respectively, (SD = 0.10-0.24). The observed cholinesterase activity levels were within the normal range. However, the consistently lower levels in green-house workers suggest the need for protective measures during the application of pesticides in the green-house.

81-1933. Taylor, J. (Plant Prod. Div., Ottawa, Ontario, Canada) **Procedures, rules and criteria for evaluation of forestry insecticides.** *Proc. Symp. Aminocarb, 1978.* pp. 7-10; 1980.

A brief, general review is given of the manner in which a pesticide is registered by the Canadian government. Matacil (aminocarb) registration is used as a specific example. Regulations pursuant to the Pest Control Products Act outline information required before registration can be considered. This information relates to the efficacy, the safety of the product for humans and to the environment, the chemistry and the analytical methodology. Data submitted for registration are reviewed by the Pesticides Section, and by consultants of other government departments if necessary. A system of phased registrations has been used in recent years. A temporary, 1 yr registration may be granted with the provision that missing information in the original application is completed, or work towards providing the information is begun, by the time of renewal of the limited registration. Models have been developed which are used to determine whether a chemical will be safe for either occupational or accidental human exposure. Approximately 12 new chemicals and 300 new uses are evaluated every year.

81-1934. Kallenbach, J.; Bagg, P.; Feldman, C.; Zwi, S. (Pulm. Unit, Dep. Med., Univ. Witwatersrand, Johannesburg, South Africa) **Experience with acute poisoning in an intensive care unit. A review of 103 cases.** *S. Afr. Med. J.* 59(17): 587-589; 1981 (9 references).

Experience gained during the treatment of 103 patients admitted to the intensive care unit of the Johannesburg Hospital due to acute poisoning symptoms is reported. Six of these patients were poisoned with organophosphates, and 2 with organochlorines; 7 of these 8 patients survived. Treatment was primarily aimed at support of vital functions. Respiratory stimulants were not used. Forced diuresis was not employed. Death occurred in a 58-yr-old man 7 days after admission for organophosphate poisoning. He died suddenly in a general medical ward with virtually normal cholinesterase levels, and was found at autopsy to have extensive atheromatous coronary artery disease.

81-1935. Packham, R. F.; Beresford, S. A. A.; Fielding, M. (Water Res. Cent., Medmenham, England) **Health related studies of organic compounds in relation to re-use in the United Kingdom.** *Sci. Total Environ.* 18: 167-186; 1981 (17 references).

A progress report is presented on studies being carried out on water supplies in the United Kingdom. Approximately 33% of the United Kingdom's water supplies derive from indirect re-use; rivers carrying industrial and domestic effluent are also used as water supplies. To determine whether any potential health risks are involved, several research projects are being conducted. A total of 324 compounds have thus far been determined in drinking water by GC-MS; 44% of these compounds were hydrocarbons, and 22% were halogenated hydrocarbons. Compounds identified included dibutyl phthalate, dioctyl phthalate, *o*-dichlorobenzene, *p*-dichlorobenzene, hexachlorocyclopentadiene and atrazine. Higher concentrations of these compounds are found in water from polluted lowland rivers compared with groundwater. Mutagenicity testing of drinking water, using the Ames test and the fluctuation test, was also carried out. It is emphasized that it would be premature to use these as routine tools for waste assessment. In an epidemiological study carried out in London, no significant correlation was found between re-use and cancer mortality. However, it is suggested that social factors, such as population mobility, may tend to blur any associations thay may exist.

81-1936. Cotruvo, J. A. (Author address not given) **EPA policies to protect the health of consumers of drinking water in the United States.** *Sci. Total Environ.* 18: 345-356; 1981 (8 references).

Activities and policies of the US EPA Office of Drinking Water are discussed in relation to carrying out the mandates of the Safe Drinking Water Act of 1974. Past, current and future regulatory actions, guidelines, emergency response actions, and the new program to assure the quality of additives to drinking water during treatment and distribution are included. The drinking water cycle, by its very nature, requires protective measures at the source of the water supply, during the treatment of the water and at

the distribution system points. The Water Act requires that National Interim Primary Drinking Water Standards and National Secondary Standards be established and met; that the National Academy of Science recommend MCLs; that lists of contaminants and goal levels which would result in no known or anticipated adverse effects on health be prepared; and that MCLs or treatment requirements be established and met. National Interim Primary Drinking Water Regulations for 21 compounds, including endrin, lindane, methoxychlor, toxaphene, 2,4-D and 2,4,5-TP (silvex) are presented in tabular form. The Criteria and Standards Division has also developed an emergency advisory program that provides documentation and advice to officials required to make emergency determinations of potability.

81-1937. Hanify, J. A.; Metcalf, P.; Nobbs, C. L.; Worsley, K. J. (Northland Births Surv., Auckland 1, New Zealand) **Aerial spraying of 2,4,5-T and human birth malformations: an epidemiological investigation.** *Science* 212(4494): 349-351; 1981 (9 references).

An investigation of the rate of birth malformations in the Northland region of New Zealand provides no evidence to associate spraying of 2,4,5-T with the occurrence of any malformation of the central nervous system, including spina bifida. A statistically significant association between spray and malformation is found in the case of talipes. Whether this association indicates a causal relation remains to be established. (Author abstract by permission. Copyright 1981 by the American Association for the Advancement of Science)

81-1938. Lauwerys, R. R. (Cathol. Univ. Louvain, Brussels, Belgium) **Occupational toxicology.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH28: 699-709; 1980 (43 references).

The major goal of industrial toxicology is the prevention of health impairments in workers handling or exposed to industrial chemicals. Hazards to humans cannot be evaluated fully by epidemiologic studies alone. Animal studies must be performed to obtain toxicity data. The hazards of extrapolating from animal to human are discussed. The importance of precise determination of the composition of test compounds is stressed; the assessment of the toxicity of 2,4,5-T, and its contaminant TCDD, is presented as an example. It is suggested that the most useful approach would be a combined experimental and clinical study to effectively evaluate the potential risks of industrial and agricultural chemicals. Recommendations could then be made for adequate preventive measures and for application of the most valid screening procedures on workers. Proposed biologic monitoring methods for occupational exposure are presented in tabular form; analysis method and tentative biologic TLVs are included. Measurement of cholinesterase in RBC or plasma is recommended for organophosphorus esters and carbamate insecticides. Analysis of *p*-nitrophenol in urine is recommended for parathion; the tentative TLV is 100 μg/l. Measurement of naphthol in urine is recommended for carbaryl monitoring. For Baygon (propoxur) the recommended method is determination of 2-isopropoxyphenol in urine. For organochlorine pesticides the proposed TLV ranges from 2 to 50 μg/100 ml. Recommended analysis methods are the determination of the specific pesticide or its metabolites in blood or urine.

81-1939. Corn, M. (Environ. Health Eng., Sch. Hyg. & Public Health, Johns Hopkins Univ., Baltimore, MD) **Regulatory toxicology.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH29: 710-726; 1980 (25 references).

Regulatory toxicology covers those situations in which the public has transferred authority to a governmental body for overseeing restrictions imposed on citizens or organizations of citizens in their utilization of chemicals. A brief history of regulations in this area is given. The assessment of risk is discussed. Risk varies from one set of circumstances to another; the societal factors involved in risk assessment play an important part in risk/benefit analysis. The judgement of risk, and the concept of a toxic substance standard are considered. Technological feasibility is also considered. Costs of control play a significant role in the determination of acceptable standards of risk control. Standards for toxic substances must take into consideration the scope and application of the standard, definitions, permissible exposure limits, regulated areas, exposure monitoring and measuring, methods of compliance, regulatory protection, protective clothing and equipment, hygiene facilities and practices, medical surveillance, employee information and training, and precautionary signs and labels. Temporary emergency standards, general duty clauses, enforcement, review of citations, records, statistics and reports are also discussed.

81-1940. McCutcheon, R. S. (Author address not given) **Toxicology and the law.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH30: 727-733; 1980 (10 references).

Legislation in the United States for the control of health hazards is discussed. The government agency of greatest concern in this area in recent years has been the Environmental Protection Agency. The duties of this agency include control of air and water pollution and the use of pesticides. The Toxic Substances Control Act was established to consolidate regulation of the chemical industry. This law promotes the acquisition of adequate chemical data to determine the effectiveness of a chemical

and the hazards associated with its usage. The Food and Drug Administration and the National Institute for Occupational Safety and Health are also important in this area. The Federal Hazardous Substances Act regulates toxic substances, which are defined as substances that have the capacity to produce personal injury or illness to humans through ingestion, inhalation, or absorption through any body surface. Aircraft spraying of pesticides is under the control of the Federal Aviation Administration. The operator must be certified, and must understand the proper disposal of used containers, the effects produced, the symptoms of poisoning caused by the substances used, the appropriate measures to take in emergencies and the location of poison treatment centers in the area.

81-1941. Spec. Pestic. Rev. Div., US EPA, Arlington, VA **Amitraz (BAAM): position document 4.** *US NTIS PB Rep.* PB80-211,428: 50 pp.; 1979 (41 references).

An EPA position document on registration of the pesticide amitraz is presented. Comments from the USDA, and the Scientific Advisory Panel and EPA's response to these concern on the economic, agricultural, environmental and health impact of the regulatory decision are included. In the discussion of risks lymphoreticular tumors in female CLEP mice, the oncogenicity and mutagenicity of the amitraz metabolite 2,4-dimethylanaline, the overall oncogenicity of amitraz and risk assessment are considered. Benefits and regulatory options are also discussed. (Author abstract by permission, modified)

81-1942. Spec. Pestic. Rev. Div., US EPA, Arlington, VA **Amitraz (BAAM): position document 3.** *US NTIS PB Rep.* PB80-211,436: 84 pp.; 1979 (35 references).

An EPA position document on registration of the pesticide amitraz is presented. In the discussion of risk analysis, risk rebuttal submissions are evaluated; lung tumors in female CFLP mice, lymphoreticular tumors in female CFLP mice, and the effects of the metabolite 2,4-dimethylanaline are considered. Human exposure to amitraz, qualitative assessment of risk data, quantitative risk estimates, and risks from substitute pesticides are discussed. Benefit analysis, the development and selection of regulatory options, review of the impacts of the major options and recommended regulatory action are also considered.

81-1943. Spec. Pestic. Rev. Div., US EPA, Arlington, VA **Silvex: position documents 1, 2 and 3. Preliminary determination concerning a rebuttable presumption against registration of pesticide products containing silvex.** *US NTIS PB Rep.* PB80-213,895: 114 pp.; 1979 (109 references).

An EPA position document concerning a rebuttable presumption against registration of pesticide products containing silvex is presented. The preliminary risk assessment includes examination of possible unreasonable risks associated with uses of the pesticide, gathering all available information to determine whether or not this or any other risk does exist, initiation of a literature search and evaluation of risk data. Limited information on exposure is used to forecast extent of risk. The risk/benefit analysis involves qualitative and quantitative risks of a pesticide, value of crop uses, availability of alternative pesticides, and exposure to man and environment. Identification of risk reducing regulatory options and proposed agency action are also considered. (Author abstract by permission, modified)

81-1944. Spec. Pestic. Rev. Div., US EPA, Arlington, VA **Fluoroacetamide (Compound 1080): position document 2.** *US NTIS PB Rep.* PB80-216,831: 23 pp.; 1980 (7 references).

An EPA position document on registration of fluoroacetamide (Compound 1080) is presented. Regulatory history and the basis of rebuttable presumption, including lack of emergency treatment, acute toxicity to mammalian and avian species, and significant reduction of populations of nontarget organisms and endangered species, are considered. Rebuttal analysis and rationale for label amendments are discussed. Risk benefit analysis involves qualitative and quantitative risks of the pesticide, availability of alternative pesticides, exposure to man and environmental identification of risk reducing regulatory options and proposed EPA action. (Author abstract by permission, modified)

81-1945. Spec. Pestic. Div., US EPA, Arlington, VA **Diallate: position documents 2 and 3.** *US NTIS PB Rep.* PB80-216,849: 60 pp.; 1980 (27 references).

An EPA position document on registration of the pesticide diallate is presented. The analysis and assessment of risk is considered, including analysis of rebuttal arguments for oncogenicity, analysis of data submitted since position document 1 for other possible adverse effects, exposure analysis, risk assessment and risks associated with alternative chemicals. Benefit analysis and development of regulatory options are also considered.

81-1946. Monnig, E. (Res. Triangle Inst., Research Triangle Park, NC) **Treatability studies of pesticide manufacturing wastewaters: carbaryl.** *US NTIS PB Rep.* PB80-224,306: 40 pp.; 1980 (24 references).

The report gives results of a bench-scale, experimental treatability study of wastewaters from the manufacture of the pesticide carbaryl. Results indicate that

both carbaryl manufacturing wastewater (mixed 1 part in 9 parts municipal wastewater) and carbaryl itself (spiked at 10 mg/l in municipal wastewater) appear suitable for biological treatment by acclimated systems if additional provision is made for removing ammonia in the effluents from these biological treatment systems. Other parameters investigated in this study [including carbaryl, α-naphthol, and toluene concentrations and the chemical oxygen demand (COD)] all showed large reductions (90% or greater). The mechanisms of reduction of these parameters include combined hydrolysis and biodegradation of carbaryl and α-naphthol, volatilization of toluene, and biodegradation of species contributing to COD. A large increase in ammonia concentration was noted in the effluent from the biological units treating carbaryl manufacturing wastewater. This ammonia concentration made the toxicological evaluation of the effectiveness of treatment problematic by rendering the effluent more toxic than the influent. Ammonia stripping lessened this toxicity. Because the technology of nitrogen control has been extensively developed, these options were not pursued further. (Author abstract by permission)

See also 81-1802, 81-1808, 81-1809, 81-1816, 81-1833, 81-1842, 81-1843, 81-1844, 81-1845, 81-1852, 81-1857, 81-1887, 81-1889, 81-1901, 81-1902, 81-1909, 81-1948, 81-2002, 81-2006, 81-2013, 81-2019, 81-2062, 81-2070 *and* 81-2071.

81-1947. Paulov, S. (Coll. Nat. Sci., Komensky Univ., Bratislava, Czechoslovakia) **Reaktibilita ryb (kaprov) na fungicid Fademorf (trimorfamid). [Reaction of fish (carp) to the fungicide Fademorf (trimorfamid).]** *Agrochemia* 21(2): 47-48; 1981 (3 references) (Slovak).

The toxicity of the fungicide Fademorf (trimorfamid) to carp was determined at up to 200 mg/l concentrations by determining the LD100 as a function of time. In contrast to mammals, fish were found to be highly sensitive to the fungicide. Mortality occurred within 24-48 hr when exposed to concentrations of 20 mg trimorfamid/l. At concentrations < 15 mg/l no fish died. Generally, survival time decreased with increased concentrations of trimorfamid.

81-1948. Vargova, M. (Res. Inst. Prev. Med., Bratislava, Czechoslovakia) **Trimorfamid - novy ceskoslovensky fungicid. [Trimorfamid. A new Czechoslovak fungicide.]** *Agrochemia* 21(2): 48-51; 1981 (11 references) (Slovak).

Results of toxicological studies performed on rats, mice and rabbits with the fungicide trimorfamid are reviewed to determine the safety of the product for use in agriculture. Acute oral toxicity (LD50), acute dermal toxicity, eye and skin irritation, subacute toxicity, subchronic toxicity, chronic toxicity, reproductive effects, mutagenic effects and neurotoxicity are considered. The acute toxicity of trimorfamid is low. Technical trimorfamid is non-irritating to both eyes and skin; irritation can be caused by the solvent. Administration at 50 mg/kg body wt for a period of 3 mo caused no hematological, biochemical or histopathological changes. In a chronic toxicity test, no adverse effects were found following administration of 67 mg/kg in feed for 1 yr. Some adverse neurotoxic effects and immunological reactions were noted in rabbits. It is concluded that for final certification of the product additional studies (inhalation studies, teratogenic and carcinogenic effects) mandated by the WHO are required.

81-1949. Minagawa, N.; Okubo, T.; Sugaya, H.; Kimatsuda, H.; Hirata, M.; Okura, K.; Takahashi, T.; Yamamoto, Y.; Watanuki, T. (Inst. Rural Med., Hiraga Gen. Hosp., Hiraga, Akita, Japan) **[Examination of results on autopsies of intoxication cases due to paraquat dichloride, particularly, on the pathological change of parenchymatous organs.]** *Akita Noson Igakkaishi (Akita J. Rural Med.)* 27(1): 47-48; 1980 (Japanese).

Pathomorphological information obtained from 5 autopsies of paraquat fatalities is reported. Necrosis of the central hepatic cells, necrosis of the distal urinary tubules, symptoms of oliguria and anuria, and epithelial edematous denaturation and necrosis of the intra-Glisson's capsular bile duct were remarkable features in the kidneys. In the pancreas edematous degeneration of the epithelial cells in the duct was observed. Zonal necrosis of the adrenal cortex was observed; particularly in the fascicular and reticular zones of acute cases. In addition, edema of the interpulmonary lobular membrane, simple hemorrhage, deposition of fibrine, intra-alveolar edema and conspicuous fibrosis were observed in the lungs. The sequence of the pathological changes due to paraquat intoxication appears to be those associated with cellular toxicity followed by complications due to disturbances of the circulatory system and then those changes caused by re-secretion of paraquat in the excretory organs.

81-1950. Simpson, D. (Dep. Clin. Chem., R. Infirm., Univ. Edinburgh, Edinburgh, Scotland) **Units for reporting the results of toxicological measurements.** *Ann. Clin. Biochem.* 17(6): 328-331; 1980 (12 references).

Fifty clinical chemistry and clinical toxicology laboratories in the United Kingdom were surveyed on the units currently employed for reporting results of drug and toxic substance assays. Completed documents were received from 47 laboratories. About 63% of the results of drug measurements (including paraquat) are reported in mass units and many labs continue to use non-SI mass units; mg/100 ml and μg/ml. In contrast, about 62% of the labs report results of digoxin assays in molar units, and a substantial number of labs use molar units for barbiturates, paracetamol, salicylates, ethanol, and anticonvulsant drugs. Confusion by clinical staff between molar and mass units was reported by some labs. At present there appears to be a lack of standardization of units for reporting drug measurements. However, adoption of a standard convention for clinical drug measurements will be difficult to achieve due to the number of specialties involved.

81-1951. Abrahamsen, L. H.; Jerkofsky, M. (Dep. Microbiol., Univ. Maine, Orono, ME 04469) **Enhancement of varicella-zoster virus replication in cultured human embryonic lung cells treated with the pesticide carbaryl.** *Appl. Environ. Microbiol.* 41(3): 652-656; 1981 (12 references).

In studies designed to determine the factors responsible for control of herpes-virus replication in an infected cell, we examined the interaction of varicella-zoster (VZ) virus-infected human embryonic lung cells with the pesticide carbaryl. The replication of the cell-associated VZ virus was enhanced 2- to 13-fold as compared to control cultures in Sevin 4 Oil-treated cultures and in cultures treated with the pesticide's active ingredient, carbaryl. The replication of VZ virus in cultures treated with the base oil plus inert ingredients found in the pesticide formulation was not enhanced. Possible differences in cytotoxicity induced by Sevin 4 Oil, pure carbaryl, or the base oil preparation were ruled out since treated and control cultures were shown to have similar numbers of viable cells when measured by trypan blue exclusion tests or by the ability of treated cells to form foci. A dose response study showed a decrease in viral enhancement in cells treated with decreasing carbaryl concentrations. (Author abstract by permission)

81-1952. Draughon, F. A.; Ayres, J. C. (Dep. Food Technol. Sci., Univ. Tennessee, Knoxville, TN 37901) **Inhibition of aflatoxin production by selected insecticides.** *Appl. Environ. Microbiol.* 41(4): 972-976; 1981 (22 references).

The insecticide naled completely inhibited production of aflatoxins B_1, B_2, G_1, and G_2 by the growth of *Aspergillus parasiticus* at a 100 ppm (100 μg/ml) concentration. The insecticides dichlorvos, landrin, pyrethrum, Sevin (carbaryl), malathion, and diazinon significantly ($P = 0.05$) inhibited production of aflatoxins at a 100 ppm concentration. However, at a concentration of 10 ppm, significant inhibition in production of aflatoxins was found only with naled, dichlorvos, Sevin, landrin, and pyrethrum. Dichlorvos, landrin, Sevin, and naled inhibited growth of *A. parasiticus* by 28.9, 18.9, 15.7, and 100%, respectively, at 100 ppm. Stimulation of growth was observed when diazinon was added to cultures. Aflatoxin B_1 was most resistant to inhibition by insecticides, followed by G_1, G_2, and B_2, respectively. (Author abstract by permission)

81-1953. Ferguson, P. W.; Clark, C. R.; Gee, S. J.; Krieger, R. I.* (Vet. Med., Univ. Idaho, Moscow, ID 83843) **Phenobarbital treatments lower DDT body burden in rhesus monkeys.** *Arch. Environ. Contam. Toxicol.* 10(3): 263-270; 1981 (36 references).

Decreased DDT, DDD, and DDE in blood and DDA in urine followed phenobarbital treatments (10 mg/kg/day, 11 days im) in 3 male rhesus monkeys (*Macaca mulatta*). Animals were fed DDT diets containing up to 500 ppm DDT during a 3-yr period. Induction of liver monooxygenases was confirmed by reduced *in vivo* antipyrine plasma half-life and increased *in vitro* oxidation rates of dihydroisodrin, *p*-nitroanisole and benz(α)pyrene by homogenates of liver obtained from closed needle biopsy. Chlorohydrocarbon blood levels significantly decreased during the induction period (days 1-11). Concentrations on day 28 were at or below pre-DDT exposure levels. Urine DDA gradually decreased in all monkeys from days 16 to 28. (Author abstract by permission)

81-1954. Packham, E. D.; Thompson, J. E.; Mayfield, C. I.; Inniss, W. E.; Kruuv, J. (Dep. Biol. & Phys., Univ. Waterloo, Waterloo, Ontario N2L 3G1, Canada) **Perturbation of lipid membranes by organic pollutants.** *Arch. Environ. Contam. Toxicol.* 10(3): 347-356; 1981 (14 references).

The ability of a range of organic pollutants, hexachlorobenzene, mirex, 1,3,5-trichlorobenzene, 2,4,6-trichlorophenol, *p*-nitrophenol, *p*-chlorophenol, DDT, and pentachlorophenol (PCP), to perturb liposomes of dipalmitoyl phosphatidylcholine (DPPC) has been measured by differential scanning calorimetry. The degree of perturbation was measured by the increase in breadth of the main DPPC phase transition in both heating and cooling scans. DDT and the phenol derivatives were effective perturbers of phospholipid, broadening the transition by as much as 12-fold. Hexachlorobenzene and mirex did not perturb phospholipid at all when mixed with DPPC at concentrations as high as 20 mol%, although 1,3,5-trichlorobenzene caused slight broadening of the main transition at this concentration. Perturbation is facilitated by the presence of a hydroxyl group on the benzene ring and hindered by increasing degrees of chloride substitution. An apparent correlation exists between the extent of phospholipid perturbation measured by differential scanning calorimetry and LD50 values for these compounds taken from the literature. This suggests the possibility of formulating an index of perturbation which could be used to screen certain classes of organic compounds for potential biological toxicity on a routine basis. (Author abstract by permission)

81-1955. Christensen, G. M.; Riedel, B. (Environ. Res. Lab., US EPA, Duluth, MN 55804) **Effect of water pollutants and other chemicals upon the activity of lipase *in vitro*.** *Arch. Environ. Contam. Toxicol.* 10(3): 357-363; 1981 (9 references).

Lipase preparations were treated *in vitro* with 100 chemicals of various classes, many of which are environmental pollutants, to determine their effect upon enzyme activity. The greatest inhibition was caused by mercuric ion and certain heavy metal cations; almost as inhibiting were pentachlorophenol (PCP), dicofol, 2,4,5-trichlorophenol, and DDT. Less inhibition was found with other inorganic salts, organic metals, other organic chemicals, and some pesticides. Apart from dichromate ion, the anions studied had a low to negligible effect on lipase. A mixture of 10 inorganic salts had an approximately cumulative inhibitory effect on enzyme activity. None of the chemicals studied caused a measurable activation of the enzyme. (Author abstract by permission)

81-1956. Verma, S. R.; Rani, S.; Dalela, R. C. (Pollut. Relevant Res. Lab., Post-grad. Dep. Zool., D.A.V. Coll., Muzaffarnagar 251001, India) **Synergism, antagonism, and additivity of phenol, pentachlorophenol, and dinitrophenol to a fish *(Notopterus notopterus).*** *Arch. Environ. Contam. Toxicol.* 10(3): 365-370; 1981 (15 references).

The toxicities of phenol (P), pentachlorophenol (PCP), and dinitrophenol (DNP) were determined separately and in different combinations with a test fish, *Notopterus notopterus*, using the procedure of Schubert that provided a simple, sensitive, and quantitative index of synergism, antagonism and additivity. The combination (P + DNP)/PCP was found to be the most synergistic, while (PCP + DNP)/P was antagonistic in nature. The (DNP + P)/PCP combination was additive in its effect. The other combinations were also synergistic, but to a lesser extent than the (P + DNP)/PCP combination. (Author abstract by permission)

81-1957. Maltoni, C.; Valgimigli, L.; Scarnato, C. (Inst. Oncol. & Tumor Cent., Bologna, Italy) **Long-term carcinogenic bioassays on ethylene dichloride administered by inhalation to rats and mice.** *Banbury Report* 5: 3-33; 1980 (4 references).

Results are presented from a long-term experimental carcinogenicity bioassay project on ethylene dichloride (EDC). Sprague-Dawley rats and Swiss mice were exposed to EDC by inhalation at 250-150, 50, 10 or 5 ppm for 7 hr daily, 5 days/wk, for 78 wk. The 250 ppm dose was reduced to 150 ppm after several days because of severe toxic effects. After the treatment period, the animals were allowed to live until spontaneous death, at which time complete autopsy and histological procedures were carried out. In rats, mortality varied by group, but without a direct relationship to treatment. The highest survival rate was in the group exposed to 5 ppm EDC. In mice, the survival rate was slightly lower in females of the group treated with 250-150 ppm EDC. This may be attributed to the general toxic effects of the compound, since the highest mortality rate was independent of tumor increase. In both rats and mice, no specific types of tumors, nor changes in the incidence of tumors, were observed in the treated animals. It was concluded that under these experimental conditions, which included a compound of high purity and a large number of animals used, EDC did not show carcinogenic effects.

81-1958. Ward, J. M. (NCI, Natl. Toxicol. Prog., Natl. Inst. Health, Bethesda, MD 20205) **The carcinogenicity of ethylene dichloride in Osborne-Mendel rats and B6C3F1 mice.** *Banbury Report* 5: 35-53; 1980 (8 references).

Osborne-Mendel rats and B6C3F1 mice were used in NCI experiments carried out to determine the possible carcinogenicity of ethylene dichloride (EDC). Animals were gavaged 5 times weekly. Doses for rats ranged from 50 to 150 mg/kg body wt, with treatment periods of 7-78 wk, followed by observation periods of up to 106 wk. Doses for mice ranged from 75 to 400 mg/kg body wt, with treatment periods of 3-78 wk, followed by observation periods of up to 91 wk. Complete necropsy and histopathological observations were carried out on dead or sacrificed animals. Weight depression was observed in most treated groups, and mortality values in high-dose groups were considerably higher than low dose and control groups. Evidence is presented for the carcinogenicity of EDC in rats and mice. A variety of tumors were observed in both control and treated animals, most of which were thought to be spontaneous. However, statistical analysis of data and histopathological observations suggest that several tumor types were induced. The pathology of the induced hyperplastic and neoplastic lesions is discussed in detail, as are the metastatic tumors that occurred.

81-1959. Ames, B. N.; Hooper, K.; Sawyer, C. B.; Friedman, A. D.; Peto, R.; Havender, W.; Gold, L. S.; Haggin, T.; Harris, R. H.; Rosenfeld, M. (Dep. Biochem., Univ. California, Berkeley, CA 94720) **Carcinogenic potency: a progress report.** *Banbury Report* 5: 55-63; 1980 (13 references).

An overview is given of current knowledge regarding the testing of various chemicals for their carcinogenic potential. It is stressed that future work should include not only determination of whether a chemical is capable of inducing cancer, but also a quantification of how much hazard a given substance possesses. Progress on the development of a potency index is described. In addition, a description is presented of an exhaustive worldwide literature search carried out to identify tests that are sufficiently complete to allow potency estimates to be made. The information is stored in a computerized data base, which facilitates rapid retrieval and manipulation of information. The data assembled are being analyzed to determine how well results in one species predict those in another, and to examine the reasons for variation.

81-1960. Hooper, K.; Gold, L. S.; Ames, B. N. (Dep. Biochem., Univ. California, Berkeley, CA 94720) **The carcinogenic potency of ethylene dichloride in two animal bioassays: a comparison of inhalation and gavage studies.** *Banbury Report* 5: 65-79; 1980 (11 references).

A comparison is made of 2 bioassays that have been carried out on the carcinogenicity of ethylene dichloride (EDC); an inhalation study which indicates no significant carcinogenic effects in rats or mice, and a gavage study which indicates significant increases in a variety of tumors in both rats and mice. Seven factors which may account for this discrepancy are discussed and evaluated. It was determined that impurities in test chemicals, contaminants in air or diet in the gavage study, and dose levels and patterns are unlikely to play important roles in the outcome. The most likely explantations for the discrepant results are suggested to be differences in responsiveness of strains of test animals, difference in route of exposure, and an artifact introduced by intercurrent mortality which would be correlated by life-table analysis. Potency analyses of both bioassays are also presented.

81-1961. Rannug, U. (Environ. Toxicol. Unit, Wallenberg Lab., Univ. Stockholm, S-106-91 Stockholm, Sweden) **The use of different metabolizing systems in the elucidation of the mutagenic effects of ethylene dichloride in *Salmonella*.** *Banbury Report* 5: 83-95; 1980 (10 references).

The mutagenicity testing of ethylene dichloride (EDC) in *Salmonella typhimurium* TA 1535 is reviewed. Two different methodologies explain the findings, which indicate that the mutagenic effect of EDC is potentiated by the S-9 mix. The first alternative involves metabolizing systems less complex than the S-9 mix (different fractions

of the S-9 or pure enzyme preparations), while the second alternative involves the use of more complex systems (liver perfusion and *in vivo* metabolism). Denaturing the S-9 fraction, and thereby inactivating the enzymes, reduces the mutagenic effect to a level apparent in the absence of a metabolizing system. This indicates that the activation is enzymatic and GSH dependent. In studies with more complex systems, EDC was added to liver perfusate and samples of the perfusate and the produced bile were examined. The bile produced greater mutagenic effects; no mutagenic effects were noted with the perfusate. A discussion is presented of the importance of the balance between activating and detoxifying processes, and it is pointed out that factors can influence this balance to give conflicting results.

81-1962. Simmon, V. F. (Genet. Toxicol. Div., Genex Corp., Rockville, MD 20852) **Review of nonbacterial tests of the genotoxic activity of ethylene dichloride.** *Banbury Report* 5: 97-103; 1980 (8 references).

A review is presented of non-bacterial tests of the genotoxic activity of ethylene dichloride (EDC), including tests on *Drosophila melanogaster*, barley kernels, and *Saccharomyces cerevisiae*. Several studies on male and female *Drosophila* larvae and adults indicate that EDC results in heritable mutations and nondisjunction. When barley kernels were exposed to EDC, both sterility and the number of chloroplast mutants increased. Studies using *S. cerevisiae* indicate that EDC may be recombinogenic, but only weakly so. Several assays suggest that EDC may be a carcinogen, and studies on *Drosophila* clearly indicate EDC is mutagenic to gonadal DNA. Therefore, the possibility of mutagenic activity of EDC to humans must be recognized.

81-1963. Spreafico, F.; Zuccato, E.; Marcucci, F.; Sironi, M.; Paglialunga, S.; Madonna, M.; Mussini, E. (Ist. Rich. Farmacol. Mario Negri, I-20157 Milan, Italy) **Pharmacokinetics of ethylene dichloride in rats treated by different routes and its long-term inhalatory toxicity.** *Banbury Report* 5: 107-133; 1980 (21 references).

Studies were conducted to determine the pharmacokinetics of ethylene dichloride (EDC) in rats. The compound was administered by oral (25-150 mg/kg), iv (1-25 mg/kg), or inhalation (5-250 ppm) routes. Results of the inhalation studies on cellular production in bone marrow indicate EDC caused no detrimental effects. There were no treatment-related abnormalities in the levels of GOT, GPT, or γ-GT enzymes. There was, however, an increase in SGOT levels after 3 mo of exposure to EDC. Other parameters that changed without being clearly dose-dependent, were bilirubin, cholesterol, Na, K, Cl, and P levels. EDC was detectable in the blood for 60 min after iv injection. EDC accumulated most rapidly in the liver; greatest levels were noted 10 min after oral administration.

81-1964. Reitz, R. H.; Fox, T. R.; Domoradzki, J. Y.; Quast, J. F.; Langvardt, P.; Watanabe, P. G. (Toxicol. Res. Lab., Health & Environ. Sci., Dow Chem. Co., Midland, MI 48640) **Pharmacokinetics and macromolecular interactions of ethylene dichloride: comparison of oral and inhalation exposures.** *Banbury Report* 5: 135-148; 1980 (10 references).

A comparison was performed between two bioassays of ethylene dichloride (EDC), one involving oral exposure and the other inhalation exposure, on the pharmacokinetics and macromolecular interactions of EDC. Osborne-Mendel rats were used to study the effects of either 150 ppm EDC inhalation over 6 hr or 150 mg/kg EDC given by gavage. Examination of the EDC pharmacokinetics in blood after inhalation indicated elimination of EDC is biphasic; EDC levels were below detection limits 18 hr after termination of exposure. When compared to results on oral pharmacokinetics, strong similarities were noted, except that peak EDC blood levels were much higher after oral exposure. In radioactive labeling studies, there were no striking differences in radioactivity distribution between target and non-target tissues by either route of administration. Other tests showed no striking differences between levels of macromolecular binding after oral exposure or after inhalation exposure. These studies failed to provide an explanation for the contradictory results of the two bioassays.

81-1965. Rao, K. S.; Murray, J. S.; Deacon, M. M.; John, J. A.; Calhoun, L. L.; Young, J. T. (Toxicol. Res. Lab., Health & Environ. Sci., Dow Chem. Co., Midland, MI 48640) **Teratogenicity and reproduction studies in animals inhaling ethylene dichloride.** *Banbury Report* 5: 149-166; 1980 (13 references).

Rats and rabbits were used to evaluate the teratogenic and reproductive effects of ethylene dichloride (EDC) after inhalation. In the teratogenic studies, groups of rats were exposed to 100 or 300 ppm EDC in air for 7 hr/day on days 6-15 of gestation. Rabbits were exposed to the same concentration on days 6-18 of gestation. Animals were sacrificed on day 21 (rats) or day 29 (rabbits) of gestation, and gross and histopathological fetal examinations were performed. In rats exposed to 300 ppm EDC, extensive maternal toxicity occurred, and implantation sites were observed in only one rat; however, all of the implantations were resorbed. EDC was not found to be teratogenic in rats inhaling 100 ppm or in rabbits inhaling 100 or 300 ppm. In reproductive studies, rats were exposed to 25, 75 or 150 ppm EDC in air for 60 days prior to breeding and throughout the breeding period. F_{1A} and F_{1B} generations (2 litters/generation) were obtained, and the number of live and dead newborn pups was determined. Pathological examinations were performed, and the results indicate that increases of external or internal malformations among treatment group F_{1A} and F_{1B} pups were not statistically different from controls. No effects on fertility were observed.

81-1966. Van Duuren, B. L. (Lab. Org. Chem. & Carcinog., Inst. Environ. Med., Med. Cent., New York Univ., NY, NY 10016) **Carcinogenicity and metabolism of some halogenated olefinic and aliphatic hydrocarbons.** *Banbury Report* 5: 189-205; 1980 (48 references).

A report on the carcinogenicity, mutagenicity, metabolism and mode of action of some halogenated olefinic and aliphatic hydrocarbons is presented. Trichloroethylene (TCE) had negative results using a variety of tests. Allyl chloride, DBCP, VDC, epichlorohydrin (ECH) and PMA did show carcinogenicity in mice. The *in vitro* metabolism of TCE is of interest because one of the intermediates is chloroform, a liver carcinogen. There is evidence that ECH, an impurity of TCE, is carcinogenic. Allyl chloride and 1,4-DCB are direct-acting carcinogens because of their structure. Because of the presence of impurities in some chemicals used in testing, the results of many of the tests are suggested to be questionable.

81-1967. Plotnick, H.; Weigel, W.; Richards, D.; Cheever, K.; Kommineni, C. (Div. Biomed. & Behav. Sci., NIOSH, Cincinnati, OH) **Dietary disulfiram enhancement of the toxicity of ethylene dibromide.** *Banbury Report* 5: 279-286; 1980 (9 references).

The effects of disulfiram on the toxicity of ethylene dibromide (EDB) were investigated using male, Sprague-Dawley rats. Rats were fed diets containing 0.05% disulfiram and then exposed to 20 ppm EDB in the atmosphere. Two control groups were established: no EDB exposure while receiving the disulfiram diet; and no disulfiram while receiving EDB exposures. In another experiment, rats were fed disulfiram, given a single, oral dose of EDB at 15 mg/kg and were sacrificed after 24-48 hr. Inhaled EDB increased the frequency of tumors and caused atrophy of the liver, kidney, spleen and testes. Disulfiram, given in combination with EDB exposures, increased the frequency of these disorders and increased EDB residues in the organs. Disulfiram increased the retention of orally administered EDB in most tissues. The mechanism by which disulfiram enhances the carcinogenicity of EDB is unclear.

81-1968. Infante, P. F.; Marlow, P. B. (Off. Carcinog. Ident. & Classif., OSHA, US Dep. Labor, Washington, DC 22010) **Evidence for the carcinogenicity of selected halogenated hydrocarbons including ethylene dichloride.** *Banbury Report* 5: 287-308; 1980 (24 references).

The carcinogenicity of several halogenated hydrocarbons, including ethylene dichloride (EDC), is reviewed. Carcinogenicity tests were positive in rats and mice for (EDC) ethylene dichloride, (EDB) ethylene dibromide, vinyl chloride (VC), epichlorohydrin (ECH), $CHCl_3$, and CCl_4. Both TCE and PCE were negative in rats but positive in mice. VB was positive in rats, but there were no data available in mice. Almost all compounds resulted in liver tumors. EDB caused tumors in almost every organ tested. The results of assays on other compounds showed susceptibility in various organs. On the basis of the studies presented, it is recommended that a concerted effort be made to reduce human exposure to these compounds.

81-1969. Fabricant, J. D.; Chalmers, J. H., Jr. (Dep. Prev. Med. & Community Health, Div. Environ. Toxicol., Med. Branch, Univ. Texas, Galveston, TX 77550) **Evidence of the mutagenicity of ethylene dichloride and structurally related compounds.** *Banbury Report* 5: 309-329; 1980 (37 references).

The mutagenicity of ethylene dichloride (EDC) and some structurally related compounds is discussed. Mutagenicity was determined by assays conducted on a variety of organisms including bacteria, yeast, plants, *Drosophila* and cell cultures. EDC was mutagenic to *Drosophila* and cell cultures, with mixed results in bacteria and plants. Ethylene dibromide was mutagenic in yeast and *Drosophila*, with mixed results in bacteria, plants, and cell culture. Vinylidene chloride showed mixed results in bacteria and cell culture. Trichloroethylene was mutagenic in yeast and cell culture, but showed mixed results in bacteria. Perchloroethylene was not mutagenic in bacteria, but was mutagenic in yeast. It is concluded that it is essential to reduce worker exposure to these chemicals and monitor for genetic damage among exposed persons.

81-1970. Anders, M. W.; Livesey, J. C. (Dep. Pharmacol., Univ. Minnesota, Minneapolis, MN 55455) **Metabolism of 1,2-dihaloethanes.** *Banbury Report* 5: 331-341; 1980 (27 references).

Studies on the metabolism of 1,2-dihaloethanes in rats are presented. Subcellular fractions of tissues were prepared by differential centrifugation, and incubations of substrate were conducted at 37°C for 30 min. Ethylene dichloride (EDC) was converted to ethylene via the intermediate formation of S-(2-chloroethyl)-GSH. *Meso*dibromobutane (DBB) was converted primarily to *trans*-2-butene. *Racemic*-DBB was converted to the *cis* isomer. Erythrobromochlorobutane (BCB) was converted to *cis*- and *trans*-2-butene. *Threo*-BCB was converted to a mixture of *cis* and *trans*-2-butene. Further studies must be performed to determine the role of metabolic intermediates in the toxicity of the 1,2-dihaloethanes.

81-1971. Buff, K.; Berndt, J. (Abt. Zellchem., Inst. Toxikol. & Biochem., Ges. Strahl. & Umweltforsch. D-8042 Nueherberg, BRD) **Interaction of DDT (1,1,1-trichloro- 2,2-bis(*p*-chlorophenyl) ethane with liposomal phospholipids.** *Biochim. Biophys. Acta* 643(1): 205-212; 1981 (17 references).

The influence of 1,1,1-trichloro-2,2-bis(*p*-chlorophenyl) ethane (DDT) and several other pesticides on the

physical state of membrane phospholipids was investigated using model lipids. The thermal dependence of fluorescence intensity of the probe parinaric acid in dipalmitoylphosphatidylcholine liposomes and lipid vesicles of mixed composition were recorded. DDT was incorporated into the liposomal bilayer. The insecticide lowered the phase transition temperature and broadened the temperature range of the transition. The effects were concentration-dependent. The results may be interpreted as a blurred and facilitated phase transition of bilayer lipids caused by intercalation of DDT between fatty acyl chains of membrane phospholipids. (Author abstract by permission)

81-1972. Wyatt, I.; Doss, A. W.; Zavala, D. C.; Smith, L. L. (Cent. Toxicol. Lab., Imp. Chem. Ind. Ltd., Alderley Park, Cheshire SK10 4TJ, England) **Intrabronchial instillation of paraquat in rats: lung morphology and retention study.** *Br. J. Ind. Med.* 38(1): 42-48; 1981 (21 references).

Studies were undertaken to determine if the rat lung was as susceptible to instilled paraquat as the rabbit lung, and to determine the concentration of instilled paraquat required to produce histopathological damage. Paraquat was directly instilled into the left bronchus at levels of 10^{-5}-10^{-12}g in 0.1 ml saline. Lung edema and macroscopic lesions 2-14 days after dosing were caused by 10^{-5}g paraquat. Subtle changes occurred in the parenchyma of the lung. No changes were seen after dosing with 10^{-7}g paraquat. Rabbit lung showed damage after treatment with 10^{-12}g. Loss of paraquat from the lung was biphasic. The initial half-life was less than 1 hr. The secondary phase obeyed first-order kinetics, and the half-life was dependent on the dose of paraquat instilled. It was suggested that a decrease in the half-life of the secondary phase with increasing dose of paraquat was associated with the production of edema and/or lung cell damage. About 50% of the instilled paraquat at 10^{-8}g dosage levels was rapidly absorbed from the lung into the plasma.

81-1973. Liu, D. (Environ. Contam. Div., Natl. Water Res. Inst., Burlington, Ontario L7R 4A6, Canada) **A rapid biochemical test for measuring chemical toxicity.** *Bull. Environ. Contam. Toxicol.* 26(2): 145-149; 1981 (13 references).

A rapid and sensitive biochemical toxicity test based on the reduction of resazurin by microbial dehydrogenase is described. Mixed bacterial cultures developed from activated sludge were incubated with resazurin solution and toxicant, and the percent inhibition was measured spectrophotometrically at 610 nm as the maximum absorbance of unreduced resazurin. The effective concentration causing 50% inhibition of the microbial dehydrogenase activity (IC50) was calculated for each toxin tested. IC50 values of sodium arsenite, sodium arsenate, and sodium cacodylate (cacodylic acid) were 25, 100, and 2000 ppm, respectively. The resazurin test was also found to give good reproducibility when potassium cyanide and mercuric chloride were examined as test toxicants at 3 different concentration levels over a period of 8 days. The bioassay may also be used to demonstrate the toxicity of phenol, 2-chlorophenol, 2,6-dichlorophenol, 2,4,6-trichlorophenol, and pentachlorophenol (PCP) to microorganisms as a function of the degree of chlorination in the phenol nucleus. Structure/function effects may also play an important role in determining the impact of a compound in the environment. When *o*-, *p*- and *m*-chlorophenol at 3 concentrations were subjected to the resazurin bioassay, differential toxicities resulted, in a manner that agreed with previously reported toxicity test data for these stereoisomers.

81-1974. Belluck, D.; Felsot, A. (Sect. Econ. Entomol., Illinois Nat. Hist. Surv., Champaign, IL 61801) **Bioconcentration of pesticides by egg masses of the caddisfly, *Triaenodes tardus* Milne.** *Bull. Environ. Contam. Toxicol.* 26(3): 299-306; 1981 (18 references).

Triaenodes tardus eggs were collected and 4 egg masses were exposed to 50 ml of pesticide solution. The pesticides and the nominal concentration of the water solutions used in the studies were: DDD (TDE), DDT and hexachlorobenzene (HCB) at 1 ppb; carbofuran at 8 ppb; dieldrin at 20 ppb; and methoxychlor, terbufos, malathion, diflubenzuron, and monuron at 100 ppb. With the exception of dieldrin and methoxychlor, pesticide bioconcentration appeared to reach relatively stable levels by 120 hr. Egg mass concentration of most of the pesticides studied reached highest levels at 72 hr after exposure and then declined to lower, stable levels. The observed increase in bioconcentration factors over 72 hr probably represents adsorption of the pesticide to the gelatinous matrix followed by absorption into the matrix and the eggs. It was concluded that passive biological systems, such as caddisfly eggs, can accumulate significant quantities of pesticide from water, and the bioconcentration factors are correlated with the physico-chemical properties of the pesticides.

81-1975. Vangilder, L. D.; Peterle, T. J. (Dep. Zool., Ohio State Univ., Columbus, OH 43210) **South Louisiana crude oil or DDE in the diet of mallard hens: effects on egg quality.** *Bull. Environ. Contam. Toxicol.* 26(3): 328-336; 1981 (16 references).

A group of 21 mallard hens was fed a diet containing 10 ppm DDE. A second group received a diet containing Southern Louisiana crude oil at 2% concentrations. A third group served as controls. Dietary oil but not DDE altered the mean size and composition of the eggs. Oil-fed hens laid eggs which were significantly lighter and smaller than those laid by hens fed control diets. The fresh yolk wt in all eggs increased at similar rates with egg wt; yolks from

oil and DDE eggs were proportionately smaller than yolks from control eggs. The fresh albumen wt in oil and DDE eggs was proportionately larger than in controls. The proportion of shell mass in DDE eggs decreased with increasing egg wt. The observed changes in both shell quality and albumen-water content are suggested to be the results of pollutant-induced changes in shell gland function.

81-1976. Calton, G. J.; Burnett, J. W. (Div. Dermatol., Sch. Med., Univ. Maryland, Baltimore, MD 21201) **Uptake of the herbicide pendimethalin by the sea nettle *Chrysaora quinquecirrha*.** *Bull. Environ. Contam. Toxicol.* 26(3): 386-388; 1981 (4 references).

Jellyfish, *(Chrysaora quinquecirrha)*, were collected from Meridith Creek, MD, and placed in aquaria containing pendimethalin at 10 ppm. The sea nettles actively incorporated pendimethalin into body tissues. The most striking was uptake by tentacles, which turned yellow with absorbed pendimethalin. Uptake began within 1 hr of exposure and increased steadily; total jellyfish levels as high as 4.2 ppm at 16 hr were recorded. Uptake was considerably higher in tentacles than in the bell. Mesentery tentacles incorporated pendimethalin to a greater extent than did fishing tentacles. Pendimethalin was not passively transported; levels in jellyfish were not as high as those of the water.

81-1977. Busby, D. G.; Pearce, P. A.; Garrity, N. R. (Canadian Wildl. Serv., Fredericton, New Brunswick E3B 4Z9, Canada) **Brain cholinesterase response in songbirds exposed to experimental fenitrothion spraying in New Brunswick, Canada.** *Bull. Environ. Contam. Toxicol.* 26(3): 401-406; 1981 (12 references).

Aerial spraying of 12, ~ 40 ha, spruce-fir plots in southwest New Brunswick was performed with 2 types of spray equipment [boom and nozzle (B&N) or rotoary atomizer (RA)] and 2 formulations of 280 g fenitrothion/ha. In 3 of the 6 plots treated with each different type of equipment, a low-drift additive was added to the fenitrothion formulation. Avian response to the additive was monitored via cholinesterase inhibition. All sampled species exhibited some degree of brain cholinesterase (ChE) inhibition when compared to controls. Species included Tennessee Warbler, Magnolia Warbler, Blackburnian Warbler, Bay-breasted Warbler and the White-throated sparrow. B&N and RA sprayed birds showed significant ChE inhibition. However, ChE values for B&N-sprayed birds were lower than RA-sprayed birds. The present study indicates that significant exposure of avian species to fenitrothion occurs during spray operations and that the B&N system produces a greater impact on these species than the RA system.

81-1978. Kawashima, Y. I.; Miyahara, T.; Kozuka, H.; Ohdaira, C. (Fac. Pharm. Sci., Toyama Med. & Pharm. Univ., Toyama, Japan) **Tissue distribution of hexachlorophene in lactating cows.** *Bull. Environ. Contam. Toxicol.* 26(3): 424-427; 1981 (7 references).

Two lactating cows were orally given a mixture of hexachlorophene (HCP), at 4 mg/kg, and cupric glycinate, at 10 mg/kg, in the diet once/day for 2 days and were then sacrificed 3 days after the last dosing. HCP residues were found in liver at 210 and 230 ng/g wet tissue wt, in muscle at 35 and 20 ng/g, in adipose tissue at 5 and 10 ng/g, and in blood at 10 and 6 ng/ml fluid. Only trace amounts were found in kidney. At 6 hr post-treatment, no HCP was found in milk. However, detectable amounts were found in milk at 24 hr after treatment. No significant changes in Cu concentrations in liver, muscle, kidney, blood, or milk of treated cows were noted when compared to controls.

81-1979. Miller, C. T.; Lok, E.; Tryphomas, L.; Rogers, C. G.; Iverson, F. (Food Dir., Health Prot. Branch, Ottawa, Ontario K1A OL2, Canada) **Effects of hexachlorocyclohexane isomers on nuclear and mitochondrial DNA synthesis in mouse liver.** *Can. J. Genet. Cytol.* 22(4): 671; 1980.

Female mice were used in studies designed to determine the effect of α-, β-, δ-, or γ-hexachlorocyclohexane (α, β- and δ-BHC, and lindane) on DNA synthesis in the liver. The mice were exposed to 250 ppm of the hexachlorocyclohexane isomers in the diet for 4 wk, then were injected sc with 300 μCi ^{3}H-thymidine/mouse 18 hr prior to sacrifice. Nuclear and mitochondrial DNA were isolated from subcellular fractions of liver homogenates. Treated animals showed increased liver weights and increased nuclear DNA specific activities, as well as increases in radioactivity incorporated into mitochondrial DNA. The amount of mitochondrial protein/g liver tissue decreased slightly, particularly for the α-isomer. It was also noted that the subsequent induction of neoplastic nodules was observed with the α- but not the β-isomer. [Paper presented at the 25th Annu. Meet. of the Genet. Soc. Canada & the Can. Soc. Microbiol.]

81-1980. Tomkins, D.; Kwok, E.; Douglas, G. (Cytogenet. Lab., Child. Hosp. East. Ontario, Ottawa, Ontario Canada) **Testing of pesticides for induction of sister chromatid exchange in Chinese hamster ovary cells.** *Can. J. Genet. Cytol.* 22(4): 681; 1980.

Six pesticides, including the fungicides captan and ferbam, the insecticides fenitrothion and rotenone, the herbicide 2,4-D, and the nematocide 1,3-dichloropropene, were tested for their ability to induce sister chromatid exchange (SCE) in Chinese hamster cells. The cells were tested with at least 4 doses of each chemical with or without metabolic activation (rat liver S-9 fraction), then grown for 24 hr. Captan and 2,4-D increased SCE slightly without metabolic activation, but had no effect in the presence of S-9. 1,3-Dichlorpropene induced significant increases in SCE with or without metabolic activation. The other 3 pesticides

had no effect on the frequency of SCE. [Paper presented at the 25th Annu. Meet. of the Genet. Soc. Canada & the Can. Soc. Microbiol.]

81-1981. Roslycky, E. B. (Res. Inst., Agric. Canada, London, Ontario N6A 5B7, Canada) **Influence of terbacil on microbiota in soil and cultures.** *Can. J. Soil Sci.* 61(1): 11-17; 1981 (27 references).

Terbacil in concentrations up to 500 μg/g of sandy loam soil had little effect on populations of actinoymcetes, bacteria, and fungi under laboratory and field conditions during a period of 5 mo. Concentrations up to 700 μg of terbacil/ml did not affect the *in vitro* growth of 111 strains of agriculturally important microorganisms, including effective, parasitic, and lysogenic rhizobia from 7 cross-inoculation groups, pathogenic, attenuated, and saprophytic agrobacteria, azotobacters, and other bacteria, actinomycetes, and fungi. Terbacil inhibited the respiration of total soil microbiota, of bacteria, and of fungi at all concentrations tested. By contrast, it stimulated the respiration of actinomycetes at concentrations up to 500 μg/ml and partially inhibited it at 700 μg/ml. Replication of bacterial and actinomycete isolates showed minimal inhibition by the extreme concentrations. (Author abstract by permission)

81-1982. DeFlora, S. (Inst. Hyg., Univ. Genoa, I-16132 Genoa, Italy) **Study of 106 organic and inorganic compounds in the *Salmonella*/microsome test.** *Carcinogenesis* 2(4): 283-298; 1981 (30 references).

The *Salmonella*/microsome test was used to study 106 compounds from 12 chemical classes for possible mutagenicity and carcinogenicity. Among the compounds tested were ethylene oxide, captan, folpet, dieldrin and DDE. Ethylene oxide showed a clearly positive response to the *Salmonella* test strains TA1535 and TA100. The range of activity (lower and upper limits of the mutagenic response) was not determined. The effect of S-9 mix containing liver S-9 fractions from Aroclor-pretreated rats on the mutagenicity of ethylene oxide produced a slight decrease. Captan demonstrated clearly positive responses to *Salmonella* test strains TA1535, TA1537, TA98 and TA100, and a weakly positive response to TA1538. The range of activity was 3-33 nmol/plate and S-9 mix effected a decrease in mutagenicity. Folpet responded positively to TA1535, TA1537, TA98 and TA100, with a weak positive response to TA1538. Range of activity was 16-133 nmol/plate. No change was caused by the S-9 mix. Dieldrin activity was -2.6×10^4. DDE activity was -3.2×10^4 nmol/plate.

81-1983. O'Grodnick, J. S.; Adamovics, J. A.; Blake, S. H.; Wedig, J. (Dep. Metab. & Anal. Chem., Bio/dynamics Inc., East Millstone, NY 08873) **The metabolic fate of ^{14}C-labeled pentachloronitrobenzene in Osborne-Mendell rats.** *Chemosphere* 10(1): 67-72; 1981 (4 references).

The fate and material balance of ^{14}C-labeled pentachloronitrobenzene (quintozene; PCNB) after a single oral dose to Osborne-Mendel rats were investigated. Male and female rats were each given oral doses of 5 mg/kg in cottonseed oil. Sex differences in the urine and fecal excretion of PCNB were noted. The total ^{14}C activity in urine averaged 10.5% for males and 33.4% for females. Total ^{14}C activity in feces averaged 72.0% for males and 53.7% for females. Liver, kidney, carcass and GI wash contained averages of 0.03, 0.02, 0.20 and 0.08%, respectively, of the administered dose. Pentachloroaniline was the major hexane extractable metabolite of PCNB in both urine and feces. The major metabolic pathway of ^{14}C-PCNB in the rat seemed to be to *N*-acetyl-*S*-(pentachlorophenyl) - cysteine with minor amounts of PCA, PCA conjugates, PCP and methyl pentachlorophenyl sulfide.

81-1984. Bahig, M. E.; Kraus, A.; Klein, W.; Korte, F. (Ges. Strahl. & Umweltforsch., Inst. Oekol. Chem., D-8042 Neuherberg, BRD) **Metabolism of pentachloronitrobenzene-^{14}C (quintozene) in fish.** *Chemosphere* 10(3): 319-322; 1981 (7 references).

Fish were exposed to ^{14}C labeled pentachloronitrobenzene (PCNB; quintozene) for periods of 6 days. The recovery of radioactivity after the 6 day period was 92%; 76% of the recovered radioactivity was in water, and 16% was in fish. The combined fish extracts yielded positive identifications for pentachloroanisol and pentachlorothioanisol. The original metabolites were conjugates of pentachlorophenol and pentachlorothiophenol. It was concluded that the major fate of PCNB in water/fish systems is substitution of the nitro group by SH and OH with conjugation and elimination into the aqueous medium. O- and S-methylations, as well as reducton of the nitro group to the aniline, are of minor importance. Overall metabolism of PCNB in the system is very fast. No dechlorinated derivatives were found, demonstrating that no real degradation occurs.

81-1985. Bahig, M. E.; Kraus, A.; Klein, W. (Ges. Strahl. & Unweltforsch., Inst. Oekol. Chem., D-8042 Neuherberg, BRD) **Excretion and metabolism of ^{14}C-2,4,6-trichlorophenol in rats.** *Chemosphere* 10(3): 323-327; 1981 (7 references).

The rate of excretion by rats of 2,4,6-trichlorophenol (TCP) in urine and feces was studied, and characterization of the metabolites was attempted. Six male Wistar rats were dosed daily via stomach tube with a dose corresponding to 1 ppm of TCP in the diet for 15 days. Storage of radioactivity reached a plateau after 3 days. At this level, excretion in the feces was 92.5% of the

daily applied dose. No radioactivity was detected in tissues of the 3 rats sacrificed on the day following discontinuation of TCP applications. The other 3 rats were sacrificed 3 days after discontinuation of treatment. Excretion decreased sharply after treatment stopped, reaching 4.3% in the urine and 1.9% in the feces after 3 days. No significant degradation of the parent compound was noted; however TCP was conjugated and to a certain extent isomerized.

81-1986. Reuber, M. D. (NCI Frederick Cancer Res. Cent., Frederick, MD 21701) **Carcinogenicity of dichlorvos.** *Clin. Toxicol.* 18(1): 47-84; 1981 (21 references).

There have been 3 chronic rat studies and 1 chronic mouse study, as well as subchronic dog and swine studies, on the toxicity and carcinogenicity of dichlorvos. Dichlorvos is carcinogenic for rats and mice, and toxic for dogs and swine. There was an increase in benign and malignant neoplasms at all sites in male rats ingesting dichlorvos. There were increases in neoplasms of the endocrine organs in dichlorvos-treated male and female rats. Neoplasms of the adrenal gland and pituitary were increased in female rats, as were neoplasms of the thyroid and mammary gland in male rats. Rats also developed fatty change and cholestasis of the liver, chronic interstitial nephritis, periarteritis, and atrophy of the testes. Dichlorvos is carcinogenic for the liver, esophagus, and forestomach of male mice, and for the bone of female mice. Male mice also developed atrophy of the testes. Hepatic changes, which were dose related, were observed in dogs and in swine ingesting dichlorvos. Chronic renal disease was also seen in dogs. Dose-related reductions in cholinesterase activity occurred in rats, dogs, and swine treated with dichlorvos. (Author abstract by permission)

81-1987. Bremner, I. (Rowett Res. Inst., Bucksburn, Aberdeen, Scotland) **Copper toxicity studies using domestic and laboratory animals.** In: *Copper in the Environment. Part II: Health Effects.* Nriagu, J. O. (John Wiley & Sons Inc.: NY): CH10: 286-306; 1979 (130 references).

Isolated cases of copper toxicosis have been reported when sheep have grazed in orchards or on pastures treated with copper-containing fungicides or molluscicides. Chronic copper toxicosis and its symptoms are described for ruminant animals, pigs, poultry and dogs. Factors which influence the development of copper toxicosis include dietary and hepatic copper concentrations, genetic factors, protein, zinc and iron concentrations and molybdenum concentrations. Copper-poisoned animals can develop a wide range of lesions affecting the blood, liver kidneys, and other tissues. However, the mechanisms behind the development of these lesions are not completely elucidated. Biochemical aspects of copper toxicosis are discussed including the development of hemolytic anemia, liver damage and damage to the kidney.

81-1988. Hodson, P. V.; Borgmann, U.; Shear, H. (Great Lakes Biolimnol. Lab., Canada Cent. Inland Waters, Fish. & Oceans Canada, Burlington, Ontario, Canada) **Toxicity of copper to aquatic biota.** In: *Copper in the Environment. Part II: Health Effects.* Nriagu, J. O. (John Wiley & Sons Inc.: NY): CH11: 307-372; 1979 (230 references).

Investigations of copper toxicity to algae indicated that toxicity occurs in varying degrees and that the toxic response is highly variable, depending on the organism. Many factors mitigate copper toxicity. The usefulness of biological monitors has been restricted to fish or invertebrates and work is needed in the area of developing an algal indicator of copper pollution. Copper also varies in its toxicity to species of invertebrates. Apart from species differences, the factor most important in affecting acute copper toxicity appears to be the binding capacity of the water. Hence toxicity decreases as hardness or organic content increases. Chronic copper toxicity varies much less from species to species than does acute toxicity. While adaptation to high copper concentrations in water or sediment occurs, it is probably due to genetic selection of hardy individuals rather than acclimation. Copper can affect growth, survival and reproduction as well as cause histopathologically observable tissue damage, decreased oxygen consumption or distress behavior in invertebrates. Impairment of osmotic and ionic regulation may be one possible cause of death. Numerous histological, physiological, and enzymatic responses of fish to near-lethal copper exposures may suggest that osmoregulatory failure during exposure to the metal is the probable cause of death. Fish populations appear adversely affected at copper concentrations well below the lethal level, so that some species may disappear without direct observable mortality.

81-1989. Birge, W. J.; Black, J. A. (T. H. Morgan Sch. Biol. Sci., Univ. Kentucky, Lexington, KY) **Effects of copper on embryonic and juvenile stages of aquatic animals.** In: *Copper in the Environment. Part II: Health Effects.* Nriagu, J. O. ed. (John Wiley & Sons Inc.: NY): CH12: 374-399; 1979 (80 references).

Copper is frequently used in algicides, fungicides, and pesticides and is a common treatment for red leg disease in amphibians. These uses result in part of the environmental contamination due to copper. When biological requirements are exceeded, copper becomes toxic to the aquatic biota. Effects of copper on aquatic life vary with certain physicochemical parameters of water. Tests have led to the conclusion that exposure levels of 5-15 μg Cu/ℓ produced no harmful effects for several aquatic species. Growth and reproduction of most freshwater fish were expected not to be obstructed by either short- or long-term exposure to copper at or below this concentration range. However, exposure levels of 5-10 μg/l produced appreciable frequencies of mortality and teratogenesis in static renewal tests with eggs of rainbow trout and several species of amphibians. There is an apparent need for a re-

evaluation of freshwater standards for copper. The interaction of copper with other metals has been shown to be very highly dependent on exposure concentration.

81-1990. Cheng, T. C. (Inst. Pathobiol., Cent. Health Sci., Lehigh Univ., Bethelehem, PA) **Use of copper as a molluscicide.** In: *Copper in the Environment. Part II: Health Effects.* Nriagu, J. O. ed. (John Wiley & Sons Inc.: NY): CH13: 402-432; 1979 (72 references).

The mechanism of copper uptake from the aqueous environment by molluscs, the mode of action of copper molluscicides on internal target tissues and systems, the cytopathological alterations at the subcellular level of the outer epithelial surfaces and the effects of stereochemistry of copper containing molluscicides are reviewed. Bioassay methods for determining potential efficacy, LC50 and LC90 values, and interactions with environmental variables of copper molluscicides, are also outlined. Brief reviews of the development of use of each copper-containing molluscide, other than $CuSO_4$, and advantages and disadvantages of various application methods are also presented.

81-1991. Zeeman, M. G. (Utah State Univ., Logan, UT) **Effects of DDT upon the hematology and immunology of the goldfish *(Carassius auratus).*** *Diss. Abstr. Int. B* 41(9): 3373; 1981.

This study examined DDT effects on goldfish hematological and immunological parameters. Adult goldfish were kept in 250 *l* aquaria at 25 ± 1°C. Fish were dosed ip with *p,p'*-DDT in corn oil. Doses ranged from 0-500 mg/kg for acute (96 hr) hematology studies to 0-50 mg/kg for subacute hematology and immunology studies. The 96 hr LD50s increased from 213 to 480 to 579 mg/kg for groups of fish weighing approximately 20, 50 or 110 g respectively. In acute hematology tests, effects of DDT dose upon 7 hematological parameters were determined. In general, numbers of erythrocytes and leukocytes (and associated parameters) were decreased with increasing DDT dose. Hematological alterations were moderated as fish size increased. In the sub-acute tests, effects of repeated sub-lethal doses of DDT upon the hematological parameters and immunological responses of medium-sized fish were investigated over a 1-2 mo span. In general, some of the hematological parameters stabilized after increased duration of DDT exposure. Nevertheless, numbers of leukocytes (especially percent lymphocytes) often remained reduced after DDT treatment. DDT treatment generally resulted in suppression of primary and secondary immune responses. Numbers of Jerne-plaque forming cells in anterior kidney and spleen were often reduced by DDT pretreatments, as were the serum titers of hemolysin, hemagglutinin and anti-bovine serum albumin. DDT also suppressed the normal rejection of scale-graft transplants (allografts). These results indicated that DDT interfered with the normal humoral and cell-mediated immune responses of this species and may help explain how pesticide exposure could result in increased susceptibility of fish to infectious diseases. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms, order No. 8104288)

81-1992. Evers, W. D. (Michigan State Univ., East Lansing, MI) **Dietary alteration of paraquat toxicity.** *Diss. Abstr. Int. B* 41(9): 3390; 1981.

Preliminary experimental results suggested that in mice the herbicide, paraquat, was more toxic when administered in conjunction with a purified diet rather than a closed formula diet. Male ICR mice fed a purified diet had a lower LD50, lower ET50, shorter survival time and lower 7 day % survival after ip injection of paraquat than mice fed a cereal based closed formula diet. The increased sensitivity to paraquat in mice fed the purified diet was evident as soon as 3 days after feeding the purified diet, and as long as 84 days after feeding. Neither the age when the diet was started nor the sex of the ICR mice had any affect on the dietary alteration in paraquat toxicity. Some difference in strains of mice was noted. Alteration of the amount and type of lipid in the purified diet did not affect the increased sensitivity to paraquat in mice fed the purified diet. Substitution of egg white solids for casein as the protein source in the purified diet resulted in an increased survival time and ET50. Supplementation of the purified diet with vitamin E and selenium, or with butylated hydroxytoluene (BHT), did not decrease the sensitivity to paraquat of mice fed the purified diet. Exposure of mice to carbon tetrachloride or a 100% oxygen atmosphere did not result in an increased toxicity of these compounds when compared the the same exposure of mice fed the closed formula diet. Mice fed the purified diet also accumulated more paraquat in the liver, kidney, and plasma, 3-12 hr after injection, than did mice fed the closed formula diet. Lung concentrations of paraquat were not changed by diet. Despite elevated plasma paraquat concentration, urinary excretion of paraquat over the 48 hr period was unchanged in mice fed either diet. This unaltered excretion of paraquat plus an increase in plasma urea nitrogen 72 hr after paraquat injection in mice fed the purified diet suggested a possible impairment of renal function. (Author abstract by permission, abridged. Copies of the thesis are available from University Microfilms order No. 8106377)

81-1993. Kondakova, E. G.; Tsoncheva, V. E.; Slavova, M. S. (Inst. Biol. & Immunol. Reprod. & Dev. Org., Bulgarian Acad. Sci., Sofia, Bulgaria) **Influence of the thiophosphorus insecticide Lebaycid on the mitotic activity in mice.** *Dokl. Bolg. Akad. Nauk* 33(8): 1133-1136; 1980 (11 references).

C57BL mice were given 50% of the median lethal dose of Lebaycid (fenthion) in water suspension via a

stomach probe. A narrow zone of toxicity was noted for both male and female animals. However, females were more resistant. Male mice exhibited a rise in mitotic index values from 6 to 72 hr of treatment, compared with controls. The same trend was noted in female mice. In females, however, mitotic index values dropped much lower at 6 hr, and at 72 hr they did not reach control values. Lebaycid stimulated the division of the bone marrow cells in male animals. However, in females a sharp inhibition of mitotic division was observed.

81-1994. Halpapp-Wood, K.; Horning, E. C.; Horning, M. G. (Inst. Lipid Res., Texas Med. Cent., Baylor Coll. Med., Houston, TX 77030) **The effect of 3-methylcholanthrene, Aroclor 1254, and phenobarbital induction on the metabolism of biphenyl by rat and mouse 9000 *g* supernatant liver fractions.** *Drug Metab. Dispos.* 9(2): 103-107; 1981 (15 references).

The metabolism of biphenyl by a 9000 *g* supernatant fraction of liver homogenates prepared from non-induced and phenobarbital (PB), 3-methylcholanthrene (3-MC) and Aroclor 1254-induced rats and mice is reported. The major metabolite in all cases was 4-hydroxybiphenyl; only very small amounts of diols were formed. An increase was noted in all monohydroxybiphenyls for rat liver 9000 *g* supernatant fractions after induction by 3-MC and the 2,5- and 3,4-diols were present in greater amounts. The effect of Aroclor 1254 induction resembled that noted for 3-MC induction. PB induction showed very little effect. Induction with 3-MC in mice also resulted in an increase in all monohydroxybiphenyls and an increased concentration of 2,5- and 3,4-diols. Aroclor 1254 induction caused an increase in 2-hydroxybiphenyl formation, but not in 4-hydroxylation. PB induction caused very little change. Effects of 3-MC induction on hydroxylation of monohydroxybiphenyls included an increase in *o*- and *p*-hydroxylation in the hydroxy-substituted ring. While 2-hydroxylation of biphenyl is not a specific effect of cytochrome P-450 induction, biphenyl can be used as a test substance in animals to recognize this type of induction.

81-1995. Huckle, K. R.; Climie, I. J. G.; Huston, D. H.*; Millburn, P. (Shell Toxicol. Lab., Shell Res. Ltd., Sittingbourne, Kent ME9 8AG, England) **Dipeptide conjugation of 3-phenoxybenzoic acid in the mallard duck.** *Drug Metab. Dispos.* 9(2): 147-149; 1981 (16 references).

Four adult mallard ducks were dosed with 10 mg/kg of 3-phenoxybenzoic acid, a metabolite of pyrethroid insecticides. By 24 hr the mallards had excreted 53% of the dose; 45% was found in the methanol-soluble fraction. The formation of a dipeptide conjugate containing valine was noted. The complete metabolic profile was complex, containing a minimum of 12 metabolites. The structure of the dipeptide conjugate was determined to be *N*-(3-phenoxybenzoyl)glycylvaline.

81-1996. Nehez, M.; Paldy, A.; Selypes, A.; Scheufler, H.; Berencsi, G.; Freye, H. A. (Inst. Hyg. Epidemiol., Univ. Med., H-6720 Szeged, Hungary) **The teratogenic and mutagenic effects of dinitro-*o*-cresol-containing herbicide on the laboratory mouse.** *Ecotoxicol. Environ. Saf.* 5(1): 38-44; 1981 (27 references).

The mutagenic or teratogenic effects of Krezonit-E (a herbicide containing 50% DNOC) were studied. In teratogenicity studies, pregnant female mice were treated ip with 15 mg/kg Krezonit-E on day 11 or on days 4, 9 and 11 of pregnancy or orally with 8 mg/kg on days 11-14. The mice were killed and the embryos were examined on day 18; bone and head cross-sections were examined histologically. In mutagenicity studies, pregnant females were given oral doses of Krezonit-E in the first or second trimester. Obvious malformations were recorded, and chromosomal aberrations were assessed in embryo liver preparations. No embryotoxic or teratogenic effects were seen in DBA or AB Jrna-Halle strain mice. A mutagenic effect was demonstrated in CFLP mice treated during trimester II, but not during trimester I.

81-1997. (Dep. Zool., Univ. Adelaide, Adelaide 5001, South Australia, Australia) **Otolith abnormalities in *Limnodynastes tasmaniensis* tadpoles after embryonic exposure to the pesticide dieldrin.** *Environ. Pollut. Ser. A* 25(1): 19-25; 1981 (8 references).

Embryos of the frog *Limnodynastes tasmaniensis* were exposed to dieldrin at 0.01-0.1 ppm. This exposure did not affect the rate of embryonic development, nor did it inhibit hatching. Little or no mortality was noted from days 19-41. On day 35 the 0.1 ppm exposure group was significantly more advanced in development than the control group. The most severe morphological abnormality reported was the bilateral swelling posterior to the eyes and dorsal to the otic capsule, accompanied by severe pigment disruption, which resulted in the appearance of 2 large transparent spots on the head. By day 19, 21 tadpoles were affected by this abnormality. Tadpoles continued to develop until day 90, when many in the 0.1 ppm group died. By day 106 all groups were affected, and most tadpoles were dead. It is concluded that the embryonic phase of anuran growth is a highly susceptible one, and that teratogens which interfere with this stage may produce multiple effects.

81-1998. Marchal-Segault, D.; Ramade, F. (Lab. Zool., Univ. Paris Sud, F-91405 Orsay, France) **The effects of lindane, an insecticide, on hatching and postembryonic development of *Xenopus laevis* (Daudin) anuran amphibian.** *Environ. Res.* 24(2): 250-256; 1981 (26 references).

Xenopus spawns were immersed in 0.5, 1, and 2 ppm lindane (γ-BHC) in tap water. The highest concentration caused a decrease of hatching rate. Tadpole mortality

was investigated until metamorphosis. Close to zero through wk 1, it showed a slow increase correlated with lindane concentration throughout the period preceding metamorphosis. The development of surviving tadpoles from hatching to metamorphosis was 4 wk longer than in controls. Moreover the average wt was lower in the treated groups. Exposed animals frequently displayed morphological abnormalities; lateral deviation of the body axis and a dorsal bump of the cranial area were observed in tadpoles, whereas darkening of pigmentation appeared in tadpoles as well as in surviving adults. The symptoms of intoxication are not specific to lindane. Neurotoxic pesticides produce the same kind of effects. The results suggest a changed endocrine function of the hypothalamo-hypophyseal axis which regulates growth and metamorphosis, and a dysfunction of the intermediate lobe of the hypophysis which controls pigmentation. (Author abstract by permission of Academic Press)

81-1999. Tsapko, V. G. (Res. Inst. Ind. Hyg. & Occup. Dis., Kiev, USSR) **K kombinirovannomu deistviyu pestitsidov i mineral'nykh udobrenii. [Combined effect of pesticides and mineral fertilizers.]** *Gig. Sanit.* 46(2): 73-74; 1981 (6 references) (Russian).

The toxic effects of the pesticides TMTD (thiram), HCCH (BHC), metafos (methyl parathion) and Rogor (dimethoate) used in combination with mineral fertilizers were studied in albino rats. The LD50 after single ig administration of Rogor, metafos, HCCH and TMTD alone were 172, 25, 400 and 740 mg/kg, respectively. The LD50 of ammonium nitrate (AN) and superphosphate (SP) alone were 2020 and 9500 mg/kg, respectively. The LD50s of binary mixtures were 470 mg/kg for metaphos + AN (1:25); 1600 mg/kg for metaphos + SP (1:100), 1870 mg/kg for Rogor + AN (1:15), 3900 mg/kg for Rogor + SP (1:50); 2200 mg/kg for TMTD + AN (1:30), 6500 mg/kg for TMTD + SP (1:100); 1580 mg/kg for HCCH + AN (1:2.5) and > 8000 mg/kg for HCCH + SP (1:10).

81-2000. Abtobkhodshaeva, N. M. (Uzbek Res. Inst. Sanit. Hyg. & Occup. Dis., Tashkent, USSR) **Vliyanie pestitsida Kayhkopa na im'nnye reaktsii orlanizma. [Effect of the pesticide Kayahope on immune reactions.]** *Gig. Sanit.* 46(2): 77-79; 1981 (1 reference) (Russian).

The effect of the contact acaricide Kayahope (4-methyl-4-nitro-3-propyl-thiodiphenylester) on specific and nonspecific factors of cellular and humoral immunity was studied in albino rats. The acaricide was given daily at 1130 mg/kg (0.1 LD50) or at 56.5 mg/kg (0.005 LD50). Kayahope at 0.1 LD50 caused inhibition of the phagocytic activity of leukocytes, decrease of the bactericidal activity of blood plasma, and marked decrease of the number of antibody-forming cells in the spleen. Inhibition of cellular and humoral immunity was not associated with clinical manifestations of poisoning. The immunological changes were less pronounced after administration of Kayahope at 0.005 LD50.

81-2001. Burkatskaya, E. N.; Viter, V. F. (Res. Inst. Ind. Hyg. & Occup. Dis., Kiev, USSR) **Primenenie mnogofaktornogo korrelyatsionnogo analiza v eksperimental'noi toksikologii pri izuchenii povedencheskikh reaktsii shivotnykh. [Use of multifactorial correlation analysis in experimental toxicology during study of behavioral reactions of animals.]** *Gig. Sanit.* 46(3): 14-16; 1981 (10 references) (Russian).

The multifactorial correlation analysis of behavioral responses of animals was used for hygienic standardization of new chemicals and pesticides. Random-bred rats were subjected to inhalation exposure to Sevin (carbaryl) in a continuous or intermittent regimen: 12.1, 23.0 and 32.1 mg/m³. After termination of exposure, parameters of conditioned reflex activity, spontaneous-motor activity, and summation of threshold impulses were determined, and correlations between 28 three-factor complexes were analyzed. It was found that the changes in correlation between parameters analyzed depended upon the exposure regimen: animals subjected to 1-wk exposure with 2-wk intervals retained the functional correlations, while animals subjected to continuous exposure or to 1-wk exposure with 1-wk intervals showed changes in the correlation coefficients indicative of early pathological changes in the mechanism of neural regulation.

81-2002. Dergacheva, T. S. (A. N. Sysin Inst. Gen. & Communal Hyg., Moscow, USSR) **Oeosnovanie predel'no dopustimoi kontsentratsii med'diammoniinogo kompleksa oksietilidendifosfonovoi kisloty vo vode vodoemov. [Substantiation of maximum permissible concentrations of copper-ammonia complex of hydroxyethylidene diphosphonic acid in bodies of water.]** *Gig. Sanit.* 46(3): 72; 1981 (4 references) (Russian).

The results of toxicological substantiation of the maximum permissible concentration (MPC) of copper-ammonia algicide complex of hydroxyethylidene diphosphonic acid (HEDP) in bodies of water are reported. Algicide at 0.6 mg/l was found to change the tests of water; 1 mg/l was found to be the threshold concentration with respect to the sanitary regimen of the body of water. The LD50s for mice and rats were 2700 and 2000 mg/kg, respectively. Subacute experiments (exposure to 400, 133 and 40 mg/kg) showed increased peroxidase activity, decreased ceruloplasmin activity and phase changes of SH-group content. All 3 doses tested produced functional changes. Chronic exposure to 4 and 0.4 mg/kg produced significant changes in peroxidase and cholinesterase activity. It was recommended that the MPC for copper-ammonia complex of HEDP be 0.6 mg/kg.

81-2003. Pillai, M. K. K.; Mittal, P. K.; Agarwal, H. C. (Dep. Zoology, Univ. Delhi, Delhi 110007, India) **Bioaccumulation, metabolism and elimination of DDT by the fresh water clam *Indonaia caerulea* (Lea).** *Indian J. Exp. Biol.* 18(12): 1439-1442; 1980 (23 references).

Clams were exposed to DDT concentrations of 0.005, 0.01 and 0.05 ppm for 19 days. Clams exposed to 0.005 ppm DDT steadily accumulated DDT until day 5, after which accumulations declined. At the four peak periods of accumulation, ΣDDT concentrations were 2.84, 3.25, 2.51, and 3.42 ppm. Clams exposed to 0.01 ppm DDT exhibited 3 peaks; concentrations were 2.36, 3.29, and 2.93 ppm. At 0.05 ppm concentrations, clams steadily accumulated DDT up to 7 days (9.75 ppm) after which clams were transferred to fresh water. It was determined over the course of the study that clams would accumulate 3.25, 3.29, and 9.75 ppm ΣDDT when exposed to 0.005, 0.01, and 0.05 ppm DDT, respectively, which gives concentration factors of 684, 329, and 195, respectively. Fluctuations in levels of ΣDDT in clams treated with 0.005 or 0.01 ppm DDT may be due to the excretion of accumulated DDT and its resorption by the clams.

81-2004. Barooah, I.; Murthy, P. S. R.; Mukherjee, S. K. (Div. Toxicol. & Exp. Med., Cent. Drug Res. Inst., Lucknow, India) **Nature of endosulfon *(sic)* induced blood sugar lowering.** *Indian J. Exp. Biol.* 18(12): 1446-1447; 1980 (8 references).

Albino, Charles Foster rats were fasted for 18 hr and then maintained on a standard pellet diet after dosing with endosulfan by various routes, to examine the effects of endosulfan on blood sugar levels. Group I rats were fed a single dose of endosulfan at 5 mg/kg suspended in gum-acacia. Group II animals received endosulfan daily for 5 days by the same route at the same dose, and group III rats received 7 daily ip injections of 5 mg/kg endosulfan dissolved in olive oil. Significantly lowered blood sugar concentrations were noted 24 hr after endosulfan administration in group I rats. Administration of more than a single dose by either the oral or ip route did not produce significant changes in blood sugar levels. Islets of groups II and III were generally similar to controls with respect to β-cell granularity. However, dilation of the blood vessels in these groups was noted. It was concluded that endosulfan lowered the blood sugar levels in rats receiving a single dose of endosulfan due to the release of insulin from the β-cells.

81-2005. Indira, M.; Kurup, P. A. (Dep. Biochem., Univ. Kerala, Trivandrum 605001, India) **Effect of blackgram fiber on toxic effects of organophosphorus insecticides.** *Indian J. Exp. Biol.* 18(12): 1529-1530; 1980 (13 references).

Male, albino, Sprague-Dawley rats were divided into three groups and fed either a control low fiber diet, the low fiber diet + malathion, or a blackgram fiber diet + malathion to investigate whether organophosphorus insecticides sprayed on plant products would cause cumulative toxicities. Rats fed the low fiber diet + malathion showed loss of weight compared to controls. Animals given blackgram + malathion gained weight. Lower acetylcholinesterase (AChE) activities were noted in rats fed the low fiber diet + malathion. Rats fed blackgram fiber, at 30%, along with malathion exhibited increased AChE activities in serum and in brain. It was concluded that blackgram fiber significantly reduced the toxic effects of malathion, perhaps through its adsorption of malathion. These findings indicate the importance of intake of adequate dietary fiber in lessening the toxic effects of organophosphorus insecticides present in low amounts in plant products subjected to insecticide sprays.

81-2006. Lusby, W. R.; Oliver, J. E.; Smith, R. H., Jr.; Kearney, P. C.; Finegold, H. (Agric. Environ. Qual. Inst., Agric. Res., SEA, USDA, Beltsville, MD 20705) **Metabolism of *N*-nitrosopendimethalin and N-nitropendimethalin by a *Streptomyces* isolated from soil.** *J. Agric. Food Chem.* 29(2): 245-250; 1981 (8 references).

[^{14}C]-*N*-Nitrosopendimethalin [*N*-(1-ethylpropyl)-*N*-nitroso-3,4- dimethyl-2,6-dinitrobenzenamine], a contaminant of the dinitroaniline herbicide pendimethalin, was metabolized to several products by a *Streptomyces* sp. isolated from soil. Identifications were made by chemical ionization and electron impact mass spectrometry, chromatographic and spectral comparisons, and synthesis. Reduction of a nitro group was characteristic of all metabolites; hydroxylation of ring methyl groups was also present in some metabolites. Metabolism of [^{14}C]-*N*-nitropendimethalin [*N*-(1-ethylpropyl)-3,4-dimethyl-*N*- 2,6-trinitrobenzenamine] yielded 2 hydroxymethyl metabolites. (Author abstract reprinted by permission of the American Chemical Society)

81-2007. Minard, R. D.; Liu, S. Y.; Bollag, J. M.* (Dep. Chem., Pennsylvania State Univ., University Park, PA 16802) **Oligomers and quinones from 2,4-dichlorophenol.** *J. Agric. Food Chem.* 29(2): 250-253; 1981 (15 references).

Incubation of 2,4-dichlorophenol (DCP) with a phenol oxidase from the fungus *Rhizoctonia praticola* caused the formation of several phenolic and quinonoid oligomers. Some of these products were highly reactive and several could be isolated and identified. Mass spectrometric analysis indicated the formation of oligomers up to the pentamer. Two dimeric quinones were identified by mass and NMR spectroscopy as 2-(2,4-dichlorophenoxy) -6-chloro-1,4-benzoquinone and 2-(2,4-dichlorophenoxy)-1,4-benzoquinone. (Author abstract reprinted by permission of the American Chemical Society)

81-2008. Shiau, S. Y.; Huff, R. A.; Felkner, I. C.* (Dep. Biol. Sci., Texas Tech. Univ., Lubbock, TX 79409) **Pesticide mutagenicity in *Bacillus subtilis* and *Salmonella typhimurium* detectors.** *J. Agric. Food Chem.* 29(2): 268-271; 1981 (13 references).

Four pesticides, captan, [*N*-[(trichloromethyl) thio]-4-cyclohexane-1,2-dicarboximide], folpet [*N*-[[(trichloromethyl)thio]phthalimide], (1,2-dibromo-2,2-dichloroethyl dimethyl phosphate), and triallate [*S*-(2,3,3-trichloroallyl) diisopropylthiocarbamate], were evaluated for their ability to induce mutations in *Salmonella typhimurium* mutants (TA1535, TA1536, TA1537, TA1538, TA98, and TA100) and *Bacillus subtilis* mutants (TKJ5211 and TKJ6321) with and without a rat liver microsomal activation system. These pesticides were more mutagenic in TKJ6321 or TKJ5211 than in TA100 or TA1535 (base pair substitution mutants). None of the pesticides required metabolic activation, but they were significantly detoxified by this metabolism. (Author abstract reprinted by permission of the American Chemical Society)

81-2009. Khan, M. A. (Res. Stn., Agric. Canada, Lethbridge, Alberta, Canada) **Reproduction and growth of progeny of female mice mated after treatment with crufomate.** *J. Environ. Sci. Health B* 16(2): 141-157; 1981 (31 references).

Female mice were treated dermally with crufomate at 50 or 100 mg/kg on days 35 and 21 before caging with untreated males to assess the effects of the organophosphorus insecticide on reproduction and litter growth. Treated mice and their offspring were observed through 2 successive reproductive periods (RP), defined as the interval between caging the females with males and whelping. Both dose levels of crufomate caused about 50% reversible inhibition of cholinesterase activity without producing any noticeable toxicity. At 100 mg/kg, crufomate caused a decreased conception rate and a reduced number of litters and young born and weaned during the 2 RPs. The higher dose of the insecticide also reduced the lactation index, wt of offspring at weaning and wt of first litter males at maturity. A prolonged gestation period and decreased index of lactation were observed in mice treated with 50 mg/kg of crufomate. The lower dose of crufomate reduced the number of litters and young weaned in the first RP and decreased the conception rate and number of litters and young born and weaned in the second RP. The weaning and mature wt of the first litter and mature wt of males in the second litter were also reduced by treatment of mice with the lower dose of crufomate. The higher dose of the insecticide reduced the body wt of the females while the lower dose caused increased adrenal wt in female mice.

81-2010. Gattavecchia, E.; Di Pietra, A. M.; Tonelli, D.; Borgatti, A. (Chem. Inst. G. Ciamician, Univ. Bologna, I-40126 Bologna, Italy) **Effect of diflubenzuron and its major degradation products on the growth of *Euglena gracilis* Z. and incorporation of glycine-U-^{14}C in protein.** *J. Environ. Sci. Health B* 16(2): 159-166; 1981 (11 references).

Diflubenzuron (I) and its major metabolites, 4-chlorophenyl urea (II), 2,6-difluorobenzoic acid (III), and 4-chloroaniline (IV) were tested for their activity on the unicellular alga, *Euglena gracilis* Z. The compounds were tested for inhibition of the growth of the alga and its protein incorporation at concentrations ranging from 10 to 200 ppm. Considerable inhibition was caused by 4-chloroaniline at every concentration tested, whereas the other 3 compounds had a slight affect only on protein incorporation. It was concluded that diflubenzuron has no lasting affect on the growth and protein biosynthesis of this widespread non-target aquatic organism at the levels tested.

81-2011. Tu, C. M. (Res. Inst., Agric. Canada, London, Ontario N6A 5B7, Canada) **Effects of pesticides on activities of enzymes and microorganisms in a clay soil.** *J. Environ. Sci. Health B* 16(2): 179-191; 1981 (27 references).

The effects of 32 pesticides on the microbial populations and urease, dehydrogenase, phosphatase, and nitrogenase activities of a clay loam soil were studied for 1 wk under laboratory conditions. The pesticides used included organophosphate, organochlorine, carbamate, pyrethrin and fumigant insecticides; herbicides; and dithiocarbamate and dicarboximide fungicides. Each pesticide was applied at a low or a high dose. Autoclaved- and streptomycin-treated soils, and a control soil, were used. Thiram decreased bacterial numbers for 2 days while chlorpyrifos caused an increase in the number of bacteria after 7 days. Some fumigants and fungicides inhibited fungal growth for 2 days. Rapid recovery and stimulatory effects were prevalent in many of the pesticide-treated samples. No significant inhibition of urease activity occurred from any of the 32 compounds, and none of the treatments decreased the formation of formazan. Inhibition of phosphatase was observed only in the soil treated with high doses of D-D and Vorlex (methyl isothicyanate). Many of the compounds tested caused a temporary reduction in nitrogenase activity.

81-2012. Harrington, J. M. (TUC Centen. Inst. Occup. Health, London Sch. Hyg. & Trop. Med., London WC1E 7HT, England) **Target organs. The genito-urinary tract.** *J. Soc. Occup. Med.* 30(2): 74-78; 1980.

The structure and function of the genito-urinary tract (particularly the kidney) are reviewed, and ways in which it can respond to toxic assault are outlined. Since excretion by the kidney is the major excretory route the body possesses, the kidney is at risk of exposure to many toxic

substances. Kidney damage is frequently related to enzyme damage. The more common industrial toxins which can damage the kidney are listed, including heavy metals, paraquat, and chlorinated hydrocarbon insecticides. Kidney damage caused by heavy metals is described in detail; indirect renal effects (arising from shock, hypovolemia, and hemorrhage) may also occur with some substances. Monitoring of toxic substances can be accomplished by measuring the toxic agent and/or its metabolites in the body fluids, or monitoring renal function.

81-2013. Matsumoto, S.; Matsumori, H.; Kuwabara, N.; Fukuda, Y.; Ariwa, R. (Sch. Pathol., Fac. Med., Juntendo Univ., Tokyo, Japan) **[Histopathological studies on the disturbance of bile ducts due to paraquat.]** *Kanzo (Acta Hepatol. Japan.)* 22(2): 309; 1981 (Japanese).

Autopsy-related optical microscopic examinations of 20 cases of paraquat intoxication are reported. Disturbance of the bile ducts accompanied by intra-hepatic stagnation of the bile was observed in 8 cases. The histopathology of these cases indicates that edematous denaturation or necrosis of the bile duct epithelium occurred. The intra-hepatic and extra-hepatic bile ducts and the gall bladder were extensively involved.

81-2014. Zolotova, T. B.; Roslavtseva, S. A. (All-Union Res. Inst. Chem. Means Plant Prot., Leningrad, USSR) **O roli mikrosomal'nykh enzimov v mekhanizme razistentnosti komnatiykh mukh k ftalofosy i Neopinaminy. [Role of microsomal enzymes in mechanism of resistance of house flies to phthalophos and Neopinamine.]** *Khim. Sel'sk. Khoz.* 19(2): 44-46; 1981 (14 references) (Russian).

To evaluate the role of microsomal enzymes in detoxication of pesticides, the synergism between piperonyl butoxide (PPB) and the pesticides Neopinamine (tetramethrin), phthalophos (phosmet) and Orthene (acephate) was studied in sensitive (S) and resistant (R) house flies strains. Flies were treated with pure insecticide at various concentrations or with insecticide in mixture with PPB (1:5 ratio); the synergistic activity was estimated by the coefficient of combined effect (CCE). The CCE values for flies resistant to Neopinamine and Orthene were 12.0 and 4.0, respectively (compared with 3.6 and 2.2 for sensitive strains). There was a direct relationship between the degree of resistance to phthalophos and the synergistic effect. These findings indicate that esterase hydrolysis of thioester bond is the major pathway of detoxication in mildly resistant flies, while in highly resistant flies, hydroxylases were induced by phthalophos and inhibited by PPB.

81-2015. Meierhenry, E. F.; Ruebner, B. H.; Gershwin, M. E.; Hsieh, L. S.; French, S. W. (Dep. Vet. Pathol., Univ. California, Davis, CA 95616) **Mallory body formation in hepatic nodules of mice ingesting dieldrin.** *Lab. Invest.* 44(5): 392-396; 1981 (28 references).

Weanling male C57BL/6 mice were given a diet containing 10 ppm dieldrin for 85 wk. The treatment group contained 71 animals; 60 mice served as controls. Swollen hepatocytes with vesicular nuclei and finely vacuolated or eosinophilic cytoplasm were noted early in the centrilobular zones of mice ingestion dieldrin. The first nodule was noted at 46 wk; 41 mice developed nodules by 132 wk. Mallory bodies (MBs) were first detected after 46 wk, and were found in 26 of the 41 mice who developed hepatic nodules. The MBs were limited to the nodules in 25 mice. Twenty-one of the nodules were carcinomas and 20 of those contained MBs. Light microscopic and ultrastructural morphology of the inclusions were similar to that of MBs reported in man and experimental animals. It was concluded that dieldrin-treated C57BL/6 mice are a suitable animal model for the investigation of MBs seen in human disease. It is also suggested that MBs may serve as a marker for neoplastic transformation in C57BL/6 mice ingesting dieldrin.

81-2016. Bengtsson, B. E.; Larsson, A. (Brackish Water Toxicol. Lab., Natl. Environ. Prot. Bd., S-61182 Nykoping, Sweden) **Hyperactivity and changed diurnal activity in flounders, *Platichthys flesus*, exposed to DDT.** *Mar. Pollut. Bull.* 12(3): 100-102; 1981 (13 references).

Flounder, *Platichthys flesus*, were force fed capsules, containing DDT in two different concentrations on days 1, 4 and 7 of the study. Low-dose fish received 2.5 mg/kg, and the high dose flounder received 12.5 mg/kg. All flounder on the low-dose diet maintained normal night-active behavior. Flounder receiving the higher dose exhibited greatly exaggerated day-time activity; the fish became 2-4 times more active than controls. The induced locomotor hyperactivity probably stems from the action of DDT on the nervous system. In both groups fed DDT, the levels of DDT in the brain were about 10% the levels found in axial muscle. Levels of DDT in liver and muscle tissues were comparable to levels found in fish caught in the Baltic Sea. This suggests that at least some fish populations in the Baltic Sea may be at risk of suffering from serious sublethal effects in the form of affected behavior.

81-2017. Colquhoun, J. R.; Dean, H. J. (New York State Dep. Environ. Conserv., Albany, NY) **Toxicity of propoxur to brook trout and landlocked salmon.** *N. Y. Fish Game J.* 27(1): 32-39; 1980 (4 references).

Static bioassay techniques were used to study the effects of propoxur on brook trout and landlocked salmon. For brook trout the maximum effect due to propoxur occurred after ~ 2 hr exposure. The 24-hr median lethal concentration was found to be 6.0 mg/l with an 85% confidence interval of 4.8-7.5 mg/l. The 24-hr EC50 was determined to be 3.0 ng/l with a confidence interval of 2.2-4.1

ng/l. For landlocked salmon the 24 hr LC50 was 11.2 ng/l with a confidence interval of 9.5-13.2 mg/l. A significant difference was found between the species responses. This may indicate a species difference or it may be due to different characteristics of the test waters. It is calculated that spraying of propoxur over watersheds would result in stream concentrations, at 1 m depths, of 0.07-0.14 ng/l. It is concluded that exposure to these concentrations for < 24 hr is unlikely to cause fish mortality. However, effects of these concentrations on behavior, stamina, growth, reproduction, and discrimination of environmental stimuli need to be investigated further.

81-2018. Denys, A.; Guilbert-Ber, E.; Levy, J. (Inst. Pharmacol., Paris, France) **Characteristics of enzymatic induction provoked by chlordane.** *NASA Rep. NASA-TM-76194* 18 pp.; 1980 (3 references).

The effects of various stresses, such as restraint and lowering or raising of environmental temperature, in mice pretreated with chlordane were investigated. Chlordane is an inhibitor of protein synthesis. It was found that restraint or exposure to a cold environment for 3 hr mobilized the chlordane stored in the adipose tissue of mice. (Author abstract by permission)

81-2019. Morita, T.; Kondo, M.; Kitanaka, H.; Inoue, K.; Kawamura, O. (Sch. Pathol. I, Hamamatsu Med. Coll., Hamamatsu, Shizuoka, Japan) **[On three cases of autopsies of paraquat intoxication.]** *Nippon Byorigakkai Kaishi (Trans. Soc. Pathol. Japan.)* 69: 151; 1980 (1 reference) (Japanese).

Two women, 63 and 68-yr-old, and 1 man, 54-yr-old, died 46 hr, 40 days and 12 hr, respectively, after ingesting up to 10 ml paraquat, either by accident or intentionally. The patho-morphological autopsy findings are reported. In the accidental poisonings, liver cirrhosis; ulcerated upper digestive tract; denaturated renal distal tubular epithelium; adrenal cortex and pancreas; and hypostatic stagnation of the lungs were observed. In the suicide case, stagnated liver bile; necrosed hepatic lesions; atrophied renal tubules; fibrosed, thickened alveolar walls; interstitial and intra-alveolar fibrosis of the lower and upper right lobes, as well as complete hemorrhage, of the lungs; and cryptococcus of the pulmonary hilus and paratracheal lymph nodes were noted.

81-2020. Yamauchi, T.; Konno, N.; Kinebuchi, H. (Sch. Publ. Health, Fukushima Prefect. Med. Coll., Fukushima, Japan) **[Increase of delayed neurotoxicity of leptophos in starved hens.]** *Nippon Noson Igakkai Zasshi (J. Jpn. Assoc. Rural Med.)* 29(6): 879-884; 1981 (16 references) (Japanese).

The effects of starvation on the susceptibility of hens to delayed leptophos neurotoxicity was studied. Groups of hens were administered 250 mg/kg leptophos po after 0, 3, 6, 9, 12 or 15 days of forced starvation. No bird showed symptoms of neurotoxic disturbance after starvation for 0-3 days. Of the 5 hens fasted for 6 days, 2 showed the onset of neurotoxic symptoms; however, paralytic death was not observed. All 5 hens fasted for 9 and 15 days showed symptoms of delayed neurotoxicity, and 3 hens of each group died after developing paralysis. Among the 5 hens starved for 12 days, 1 died of acute intoxication, 3 showed symptoms of delayed neurotoxicity and 1 died after development of paralysis. It was concluded that the severity of delayed neurotoxicity was directly related to length of starvation. Depletion of adipose tissue beyond a certain level by starvation markedly increased the neurotoxicity.

81-2021. Kurosawa, K.; Asanuma, S.; Abe, E.; Horiguchi, Y.; Sasaki, K.; Matsushima, S.; Suzuki, A. (Nippon Inst. Rural Med., Usuda, Nagano, Japan) **[Effects of the chlorine-containing organophosphorus pesticide, prothiophos, on mammals.]** *Nippon Noson Igakkai Zasshi (J. Jpn. Assoc. Rural Med.)* 29(6): 920; 1981 (Japanese).

The persistence and toxicity of prothiophos (Tokuthion) to mammals was studied. Groups of rats were treated with 10 and 30 mg of prothiophos/kg/day every 10th day for 100 days. After administration, animals were sacrificed on days 5, 10 or 20. Prothiophos residues in blood and organs were less than the detection limit on day 5; however, adipose tissues contained higher levels, particularly in females. Animals given 100 or 300 mg/kg/day contained detectable residues on day 80; therefore, greater persistence in the body than leptophos or chlorpyrifos is suggested. In monkeys administered prothiophos at 10 and 20 mg/kg/day every 10th day for 100 days, cholinesterase activity in whole blood was reduced after each administration. However, the degree of reduction was lower than those of leptophos and chlorpyrifos. The changes in electroencephalograms attributable to prothiophos were not positively confirmed after administration of prothiophos 13 times.

81-2022. Iwasaki, M.; Harada, T.; Miyaoka, T.; Tsuda, S.; Shirasu, Y. (Toxicol. Div., Inst. Environ. Toxicol. Kodaira, Tokyo, Japan) **Effects of maleic hydrazide on cigarette smoke inhalation toxicity in Syrian golden hamsters.** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 6(1): 17-24; 1981 (12 references).

The effects of maleic hydrazide (MH) on the inhalation toxicity of cigarette smoke was studied using male golden hamsters with Hamburg's type-II inhalation apparatus. Hamsters were exposed to smoke of cigarettes containing 1% sodium salt of maleic hydrazide (MH-Na) and smoke of cigarettes containing 1% diethanolamine salt of maleic hydrazide (MH-DE) for 8 min twice daily, 5

days/wk for 26 wk. The results are compared to findings on groups of non-smoke exposed, sham-smoke exposed, and reference cigarette-smoke exposed animals. Suppression of body wt gain, reduction of feed efficiency and increase of blood sugar level were observed in all smoke exposed groups; the effects were most severe in animals exposed to MH-DE treated cigarettes; reduced levels of urea-nitrogen and total protein were also observed. However, addition of MH-Na to cigarettes resulted in no significant differences from the reference-smoke exposed group. Pathohistological change was observed in the tissues of the nasal cavity, larynx and lungs of all smoke-exposed groups. The effects were concluded to be due to cigarette smoke, not MH. It is suggested that MH-DE may have had a slight reinforcing effect on cigarette smoke, and that MH-Na did not produce this effect.

81-2023. Mihara, K.; Ohkawa, H.; Miyamoto, J. (Res. Dep., Pestic. Div., Sumitomo Chem. Co. Ltd. Takarazuka, Hyogo, Japan) **Metabolism of tolclofos-methyl in rats and mice.** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 6(1): 65-74; 1981 (14 references).

Within 1 wk of a single oral administration to rats and mice of ^{14}C-tolclofos-methyl [Rizolex, *O,O*-dimethyl *O*-(2,6-dichloro-4-methylphenyl) phosphorothioate)] at 5 mg/kg, 87-91% of the administered ^{14}C was excreted in feces and urine. The remaining amount of ^{14}C in rats or mice after 1 wk was < 1% of the administered amount. Tissue residues were < 0.06 ppm. In the excreta of both species at least 14 different metabolites of tolclofos-methyl were detected; 13 of these were common to both species. Tolclofos-methyl was mainly metabolized via the oxidative desulfurization of the P=S to a P=O group, the oxidation of the 4-methyl group and the cleavage of the P-O-aryl- and P-O-methyl bonds into 3,5-dichloro-4-hydroxybenzoic acid. This metabolite was excreted in its free state in rats, but was found to be conjugated with glycine in mouse excreta.

81-2024. Eto, M. (Lab. Food Chem., Himeji Women's Coll., Himeji, Hyogo, Japan) **[Structure and avian teratogenicity of organophosphorus compounds.]** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 6(1): 95-106; 1981 (75 references) (Japanese).

Results of studies on the avian teratogenicity of organophosphorus and methyl carbamate insecticides are presented. Dicrotophos, diazinon, parathion, esterine (physostigmine) and carbaryl were shown to be strongly teratogenic. Carbaryl caused only type-I malformations and parathion generally caused only type-II malformations. The other 3 compounds caused both types I and II at high doses and, generally, only type-I at low doses. The mechanism involved in causing type-I malformations is believed to be reduction of co-enzyme NAD levels in the embryo, induced by the inhibition of kynurenine formamidase (KFase) in the vitelline membrane. The mechanism of type-II malformations is considered to be the disturbance of the cholinergic system due to the inhibition of acetylcholinesterase (AChE).

81-2025. Ebel, R. E. (Dep. Biochem. & Nutr., Virginia Polytech. Inst. & State Univ., Blacksburg, VA 24061) ***In vitro* effects of chlordecone (Kepone) on hepatic microsomal cytochrome P-450.** *Pestic. Biochem. Physiol.* 14(3): 221-226; 1980 (24 references).

Studies were conducted to determine the effect of Kepone (chlordecone) on rat liver microsome preparations. The binding of Kepone to the microsomal cytochrome P-450 was monitored by spectroscopy, following the increase in absorbance at 387 nm and the decrease at 420 nm after the repeated additions of Kepone to the preparation. It was observed that the binding resulted in a Type I spectral change. Kepone was found to inhibit aminopyrine *N*-demethylase, *p*-nitroanisole *O*-demethylase and aniline *p*-hydroxylase; the first 2 involved competitive inhibition and the latter by non-competitive inhibition.

81-2026. Kavlock, R. J.; Chernoff, N.; Rogers, E.; Whitehouse, D. (Exp. Biol. Div., Health Effects Res. Lab., US EPA, Research Triangle Park, NC 27711) **Comparative tissue distribution of mirex and chlordecone in fetal and neonatal rats.** *Pestic. Biochem. Physiol.* 14(3): 227-235; 1980 (19 references).

Studies were conducted to determine the fate of mirex and Kepone (chlordecone) in the tissues of fetal and neonatal rats. Pregnant rats were dosed with 5 mg/kg of either compound on days 15, 18 or 20 of gestation. At 4, 25 or 48 hr after dosing, the animals were sacrificed and the tissues of both the mothers and the fetuses were analyzed. Maternal levels of both compounds were 4 to 5-fold higher than fetal levels. Kepone appeared to concentrate in both maternal and fetal tissues at a greater rate than mirex. Another study was conducted by dosing the mothers with either 1 or 10 mg/kg/day of Kepone or mirex after the birth of the litters. At selected intervals, pups were sacrificed and analyzed. Mirex was found in higher concentrations in the milk of the mothers. Mirex levels in the tissues of the pups was a function of milk levels. Kepone levels increased throughout the course of the study.

81-2027. Mohanachari, V.; Bhargava, D.; Indira, K.; Swami, K. S. (Dep. Zool., Sri Venkateswara Univ., Tirupati 517502, India) **Influence of malathion on the catalytic potential of glutamate dehydrogenase in sheep brain.** *Pestic. Biochem. Physiol.* 14(3): 271-274; 1980 (17 references).

The effects of malathion on glutamate dehydrogenase in sheep brain was examined. Brain tissue

extracts were dialyzed and used as the enzyme source. A reaction mixture composed of substrate and buffer was incubated with malathion. After the scheduled incubation period, the reaction was terminated with glacial acetic acid. Enzyme activities were determined colorimetrically. The effect of temperature was determined by incubating at temperatures ranging from 10 to 37°C. Incubations with the pesticide increased the activity of glutamate dehydrogenase. The V_{max} of the reaction increased by 47.5% and the K_m value decreased by 50%. The activation energy values of enzymes exposed to pesticide decreased. It is concluded that the energy barrier for enzyme activation diminished under malathion stress.

81-2028. Skonieczna, M.; Sitkiewicz, D.; Bicz, W. (Dep. Drug Metab., Inst. Biopharm., PL-02097 Warsaw, Poland) **Modification of oxidative phosphorylation in brain mitochondria during development and aging by the oxygen analog of ronnel.** *Pestic. Biochem. Physiol.* 14(3): 314-318; 1980 (21 references).

The action of the oxygen analog of ronnel (OAR) on oxidative phosphorylation in brain mitochondria of white Wistar rats during development and aging was studied. Mitochondria were isolated from brains of rats aged 4 and 16 days, and 2 and 18 mo. Oxygen uptake in the reaction mixtures was determined polarographically. The phosphorylation index ADP/O and respiratory control ratio were calculated. At all ages tested, addition of OAR to brain mitochondria resulted in the uncoupling of oxidative phosphorylation. However, the phenomenon was found to be age dependent; mitochondria from the brain of 18-mo-old animals were most sensitive and those from newborn (4-day-old) rats were least sensitive. It is suggested that the differences in sensitivity to the insecticide may be partially explained by the increased activity of the respiratory chain during development, consisting of incorporation of phospholipid molecules into membranes. It is assumed that the membrane phospholipids act as receptors for organophosphorus insecticides, and the younger mitchondrial membranes would have fewer of these receptor sites, resulting in a lowered ability to bind the insecticide molecule.

81-2029. Miller, C.; Nesnow, S.; Sarrif, A. (Univ. Alabama, Birmingham, AL 35294) **Dieldrin and related compounds as modifiers of polycyclic hydrocarbon carcinogenesis in cell culture.** *Proc. Am. Assoc. Cancer Res.* 22: 118; 1981 (1 reference).

C3H 10T1/2 cells were used in studies carried out to determine the effects of dieldrin, aldrin and endrin on the morphological transformation by 3-methylcholanthrene (3-MC) and benzo(a)pyrene (BP). Carcinogen at concentrations ranging from 0 to 10 μg/ml and insecticides at levels ranging from 0 to 40 μM were added 24 hr after the cells were seeded, and incubation was for 3 or 24 hr. Only dieldrin transformed the cells, causing the formation of Type II foci at a transformation frequency (TF) of 0.3-0.5/1000 surviving cells. In addition, dieldrin enhanced the TF of cells by 3-MC and BP. Endrin caused no change in the frequency of cell transformation caused by the carcinogen, while aldrin caused a marked inhibition of the transformation caused by either carcinogen. In other experiments in which hydrocarbon and insecticide were added for 3 hr and fresh media containing only insecticide was then added for 21 hr, transformation was inhibited by all 3 insecticides.

81-2030. Senczuk, W.; Pogorzelska, H.; Debska, M. (Dep. Toxicol., Inst. Bioanal. & Environ. Stud., Med. Acad. Poznan, PL-60780 Poznan, Poland) **Wchlanianie kwasu 2,4-dwuchlorofenoksyoctowego prezez skore. [Absorption of 2,4-dichlorophenoxyacetic acid through the skin.]** *Rocz. Panstw. Zakl. Hig.* 31(6): 611-614; 1980 (5 references) (Polish).

The degree of percutaneous absorption of 2,4-dichlorophenoxyacetic acid (2,4-D) was studied. Experiments were carried out on Wistar rats using the commercial preparation, Pielik, in aqueous solution (0.5, 1, 2, 4 and 5% solution of 2,4-D). Rats' tails were dipped in these solutions for 2, 4 and 6 hrs. 2,4-D content in rats' urine was determined in relation to the concentration of the prepared test solution and in relation to the duration of the exposure. The quantity of 2,4-D in the urine was determined by gas chromatography after extraction from the urine and its esterification. It was found that quantity of 2,4-D discharged in the urine is proportional to the concentration of 2,4-D in test solution, as well as to the duration of exposure.

81-2031. Costlow, R. D.; Manson, J. M. (Dep. Environ. Health, Univ. Cincinnati, Cincinnati, OH) **The heart and the diaphragm: target organs in herbicide-induced neonatal death.** *Teratology* 23(2): 31A; 1981.

Pregnant Long-Evans rats were exposed to nitrofen on day 11 of gestation (day 1 = sperm present). This oral exposure produced a dose-related incidence of neonatal respiratory distress and death. The neonatal LD50 was 116 mg/kg given to the dam on day 11. Term fetuses had an increased incidence of hydronephrosis, diaphragmatic hernias, and cardiac malformations. The hydronephrosis was not incompatible with life as this lesion was present in survivors. Diaphragmatic hernia accounted for approximately 20% of the deaths and lethal cardiac malformations, notably ventricular septal defects (VSD), double outlet right ventricle (DORV), and transposition of the great vessels, accounted for an additional 50-60% of the neonatal mortality. After a single oral dose, nitrofen (^{14}C) was distributed primarily into the maternal fat, with lesser amounts found in other maternal tissues, and in the embryonic compartment. The peak concentration of label-

ed material occurred at 7-9 hr after dosing in the maternal blood and 4-6 hr post-exposure in the embryonic compartment. The half-life of the label in the maternal blood was 6.8 days. Two of the metabolites were 4'-amino and 4'-acetamido derivatives, resulting from reduction or reduction plus acetylation of the 4'-nitro moiety of the nitrofen molecule. In a separate experiment, the purified 4'-amino metabolite was found to have no adverse effect on neonatal survival when administered orally on day 11 of gestation at doses up to 2.5 mg/kg. [Presented at the 21st Annu. Meet. Teratol. Soc.] (Author abstract by permission)

81-2032. Courtney, K. D.; Andrews, J. E. (US EPA, Research Triangle Park, NC) **Perinatal exposure to hexachlorobenzene (HCB).** *Teratology* 23(2): 31A-32A; 1981.

Hexachlorobenzene (HCB) was administered daily by oral intubation to CD-1 mice for the last 4 or 7 days of gestation at doses of 10 or 50 mg/kg in corn oil. Fat, skin, muscle, blood, liver and brain of the maternal and neonatal mice were assayed for HCB on the first or 20th day postpartum (pp). On day 1 pp, the maternal tissues had high concentrations of HCB, especially the skin and fat. By day 20 pp, the HCB concentration in all the tissues were depleted and were much lower than the values of corresponding non-pregnant mice. The concentration of HCB in neonatal tissues was low on day 1 pp, especially the fat, skin and muscle. In order to simulate a human exposure situation, additional litters were reduced to 2 neonates/litter. In these mice, the maternal body burdens of HCB were depleted by day 20 pp. The HCB tissue concentrations in the neonatal mice, 2/litter, were as high as those found in neonates from full litters. The lactational excretion of HCB was equivalent in the mothers with full litters compared to those with 2/litter. [Presented at the 21st Annu. Meet. Teratol. Soc.] (Author abstract by permission)

81-2033. Khera, K. R.; Whalen, C.; Angers, G. (Health Prot. Branch, Natl. Health & Welfare, Ottawa, Ontario, Canada) **Teratogenicity study on pyrethrins and rotenone (of natural origin) and ronnel in pregnant rats.** *Teratology* 23(2): 45A-46A; 1981.

Insecticidal formulations in the form of dusts or aerosols containing rotenone from the root of *Derris elliptica* and pyrethrins from the flower of *Pyrethrum cineraefolium*, are commonly used in homes and gardens. Ronnel (fenchlorphos), a systemic insecticide, is used to control house flies and, upon oral treatment, ectoparasites of cattle. These insecticides are extensively used and since their teratologic potential has not been fully investigated, the present study was conducted. Technical grades of rotenone at 0, 2.5, 5 or 10 mg/kg doses, pyrethrins at 0, 50, 100 or 150 mg/kg, and ronnel at 0, 400, 600, or 800 mg/kg, suspended in corn oil, were administered orally in single doses on days 6-15 of pregnancy in Wistar rats. (Rotenone and pyrethrins were of natural origin). The dams were killed on the last day of pregnancy and all fetuses were evaluated following routine teratologic methods. Rotenone was associated with an increased number of non-pregnant rats and resorptions at 10 mg/kg dose; reductions in maternal body wt gain, fetal wt and skeletal ossification; and increased incidence of extra ribs at 5-10 mg/kg; no significant effects were noted at 2.5 mg/kg. A dose-related increase in the incidences of resorption in pyrethrin-treated groups and extra-rib in ronnel-treated groups were observed at all test doses. [Presented at the 21st Annu. Meet. Teratol. Soc.] (Author abstract by permission)

81-2034. Kuhlmann, R. S.; Cameron, R. H.; Kolesari, G. L.; Wu, A. (Dep. Anat., Med. Coll., Univ. Wisconsin, Milwaukee, WI) ***N,N*-diethyl-*meta*- tolumide: embryonic sensitivity.** *Teratology* 23(2): 48A; 1981.

It was found that *N,N*-diethyl-*m*-toluamide (Deet, DET, DETA), the active ingredient in most commonly used insect repellents, exhibits a substantial teratologic and embryotoxic effect in the chick embryo. Prior to the acceptance of this substance for human use, Deet underwent extensive toxicologic tests in adult animals. Unfortunately, as with many such compounds, no screening on its specific teratogenic potential was reported. This study was specifically designed to address the question of the teratologic and embryotoxic potential of Deet. Genetically normal white leghorn chick embryos were exposed, at various times during the second incubation day, to 1.27 μmol doses of Deet. Application was by topical administration of 10 μl of a Deet-mineral oil solution directly on the chorioallantoic membrane. Forty one percent of the experimentally treated embryos survived to incubation day 15. Close examination of the 15-day-old embryos revealed 33% of them had gross malformations. By far, the largest group of anomalies were cardiovascular, either ventricular septal defects or anomalous aortic arch patterns. Musculoskeletal defects, such as rumplessness, amelia and malrotated limbs, were the second most frequently seen group. Some malformations of the central nervous system did occur. The malformation and mortality rates for the Deet-mineral oil treated embryos were significantly higher compared with vehicle and untreated controls. [Presented at the 21st Annu. Meet. Teratol. Soc.] (Author abstract by permission)

81-2035. Rogers, J. M. (Dep. Biol., Univ. Miami, Coral Gables, FL) **Postnatal mirex cataractogenesis: the role of lowered plasma protein levels.** *Teratology* 23(2): 58A; 1981 (2 references).

It was previously observed that cataracts occurred in pups of lactating female rats given 10 mg/kg/day mirex on days 1-4 postnatally. In this study it was found that prenatal exposure to mirex can induce cataracts in the fetus as well. Mirex exposure causes fetal hypoproteinemia,

leading to fluid accumulation in the tissues. Since overhydration of the lens is a known cause of cataracts, this study was undertaken to investigate plasma protein levels in rat pups from mothers treated postnatally with mirex. Maternal Long-Evans rats were intubated with 10 mg/kg/day mirex in peanut oil on days 1-4 after parturition. Litters were culled to 8 on day 1. Blood was drawn from the carotid artery or jugular plexus. Plasma protein was measured by the Lowry method. Plasma protein levels in treated litters were significantly reduced on days 10 (43.7 *vs.* 57.3). Cataracts first appeared on day 14, and day 14 pups with cataracts had significantly lower plasma protein levels than treated pups without cataracts (44.6 *vs.* 56.1). Levels on day 14 were similar in controls and treated pups without cataracts. This data strongly suggests that neonatal hypoproteinemia plays a causative role in postnatal mirex cataractogenesis. [Presented at the 21st Annu. Meet. Teratol. Soc.] (Author abstract by permission)

81-2036. Umpierre, C. C. (Dep. Biol., Cayey Univ. Coll., Univ. Puerto Rico, Cayey, Puerto Rico) **Embryolethal and teratogenic effects of sodium arsenite in rats.** *Teratology* 23(2): 66A; 1981.

Pregnant Sprague-Dawley rats were given a single ip injection of an aqueous solution of sodium arsenite (11 mg/kg of maternal body wt) on one of days 6-12 of gestation. Control rats were injected ip with a comparable volume of distilled water. Pregnancy was terminated at day 20, resorption sites were counted, and fetuses were recovered, weighed and fixed for examination of soft-tissue malformations and skeletal defects. Arsenite treatment resulted in a significant increase in fetal deaths when administered during days 6-10 (57-61% resorption), with the exception of day 8 (32% resorptions). A significant decrease in fetal weights was observed in the arsenite-treated group (days 6-8) when compared with controls. A gradual increase in the frequency of abnormalities was observed with days of gestation (11.3% on day 6 to 33.3% on day 10). Treatment at days 8, 9, and 10 caused the greatest percentages of malformed offspring (29%, 26.8%, 33.3%, respectively). The most frequent soft-tissue malformations were brain and eye defects, which predominated on days 7-9, while skeletal defects (ribs and vertebrae) predominated on day 10. Arsenite treatment on days 11 and 12 resulted in a low incidence of fetal deaths (12-32%) and malformations (7-18%). No significant decrease in fetal weights, nor malformations were observed in the control group. [Presented at the 21st Annu. Meet. Teratol. Soc.] (Author abstract by permission)

81-2037. Vohland, H. W.; Portig, J.; Stein, K. (Inst. Toxicol. & Pharmakol., Philipps Univ., D-3550 Marburg, BRD) **Neuropharmacological effects of isomers of hexachlorocyclohexane.** *Toxicol. Appl. Pharmacol.* 57(3): 425-438; 1981 (29 references).

Isomers of 1,2,3,4,5,6-hexachlorocyclohexane (BHC; HCH) have been reported to reduce the sensitivity of rats to the convulsant action of pentylenetratrazol (PTZ). The effect has been reexamined with a view to assessing whether γ-HCH, the insecticide lindane, and its nonconvulsant isomers act alike as PTZ antagonists. In a preliminary survey, the kinetics of HCH concentrations in brain were established after oral doses of the isomers α through δ. Brain:blood concentration ratios, estimated at the time of peak brain content, were smaller for β-HCH than the other isomers. Approximate half-lifes, recorded in females, for the elimination from brain were, in days δ-HCH, 0.5; γ-HCH, 1.5; α-HCH, 6; β-HCH, 20. PTZ-antagonistic action was tested for and was confirmed to be a property of all 4 isomers, using as a measure of effect the PTZ concentration in brain after the onset of the first seizure that developed while the drug was infused iv at a constant rate. Minimally effective concentrations (MEC) of HCH in brain indicated that the order of potency was β-HCH ~ γ-HCH > δ-HCH > α-HCH. The MEC were 3 to 5 times lower than brain concentrations associated with signs of neurotoxicity, except for γ-HCH for which the difference was negligible. For single oral doses of α-, β-, and δ-HCH onset, intensity and duration of the PTZ-antagonistic effects were related to brain content of HCH. After γ-HCH, the state of lowered sensitivity of PTZ was preceded by a transient state of heightened sensitivity while brain content of HCH was rising. Once developed, the PTZ-antagonistic effect of γ-HCH was unrelated, in its intensity and duration, to the HCH concentration in brain. It is concluded that the effects of γ-HCH and of its nonconvulsant isomers have different mechanisms, α-, β-, and δ-HCH antagonizing PTZ in a manner analogous to that of certain kinds of anticonvulsant. In distinction to the state after treatment with α-, β-, or δ-HCH, the brains of rats given γ-HCH contained substantial quantities of metabolites. The major one of these, (3,6/4,5)-1,2,3,4,5,6-hexachlorocyclohexane- 1, was found to have PTZ-antagonistic action. However, evidence is presented to show that metabolites are unlikely to contribute to the development or maintenance of the effect produced by the parent compound. (Author abstract by permission)

81-2038. Siebenlist, K. R.; Taketa, F. (Dep. Biochem., Med. Coll. Wisconsin, Milwaukee, WI 53226) **Interactions of triethyltin bromide with components of the red cell.** *Toxicol. Appl. Pharmacol.* 58(1): 67-75; 1981 (21 references).

Triethyltin bromide interacts with cat hemoglobin and increases its oxygen affinity. The bound complex was visualized by isoelectric focusing on acrylamide gels. Human and trout hemoglobins showed no evidence of interaction with the reagent when examined in the same way. Triethyltin bromide was found, however, to cause hemolysis of trout, cat, and human red cells at physiological temperatures. The hemolytic effect was associated with inhibition of glycolysis as well as of mem-

brane ATPase. Inhibition of glycolysis was identified with selective inhibition of hexokinase. Thus, in addition to cat hemoglobin, hexokinase and membrane ATPase are identified as red cell components that demonstrate functional consequences of interaction with triethyltin bromide. These three proteins are among the few that are known to bind the reagent. (Author abstract by permission)

81-2039. Agarwal, N.; Sanyal, S.; Khuller, G. K.; Chakravarti, R. N.; Subrahmanyam, D. (Dep. Biochem. & Exp. Med., Postgrad. Inst. Med. Educ. & Res., Chandigarh 160012, India) **Acute exposure of rhesus monkeys to dieldrin: effect on lipid metabolism.** *Toxicol. Appl. Pharmacol.* 58(1): 100-104; 1981 (12 references).

Rhesus monkeys have been administered a single oral dose of dieldrin (20 mg/kg body wt) and their lipid metabolism has been investigated 24 hr after the treatment. There was an increased accumulation of lipids, particularly triacylglycerols in adipose tissue, liver, and kidney, while the lipid profile of plasma did not change. An increased conversion of [U-^{14}C]glucose into hepatic total lipids and triacylglycerols was observed. Lipolytic activity in tissues and postheparin plasma was, however, elevated. No change was found in the endogenous lipid secretion from the liver and in the removal rate of lipids from the circulation. Thus accumulation of triacylglycerols in the tissues on dieldrin administration seems to be due to increased lipid synthesis. (Author abstract by permission)

81-2040. Yarbrough, J. D.; Chambers, J. E.; Grimley, J. M.; Alley, E. G.; Fang, M. M.; Morrow, J. T.; Ward, B. C.; Conroy, J. D. (Dep. Biol. Sci., Mississippi State Univ., Mississippi State, MS 39762) **Comparative study of 8-monohydromirex and mirex toxicity in male rats.** *Toxicol. Appl. Pharmacol.* 58(1): 105-117; 1981 (23 references).

Male rats were fed 0, 0.5, 5.0, 50, and 75 ppm mirex or 8-monohydromirex for 28 days. There were no consistent differences between wt gain of treated or control groups. There were significant increases in liver wt/body wt in the 5, 50, and 75 ppm mirex and 8-monohydromirex treatment groups. Serum β-glucuronidase was elevated in the 0.5, 50, and 75 ppm mirex treated groups, and was elevated in the 5, 50, and 75 ppm 8-monohydromirex treated groups. There were no consistent changes in serum sorbitol dehydrogenase in any treatment group, but there were significant increases in liver sorbitol dehydrogenase at all levels for both toxicants. Hepatic microsomal parameters were induced by both compounds. No consistent toxic effects resulting from mirex or 8-monohydromirex treatment were indicated by serum glucose, protein, and cholesterol or by selected hematological factors. The histological changes observed in the livers of animals treated with mirex and 8-monohydromirex included cells swelling with increased cytoplasmic density; a dense homogenous region centered around the nuclear area; hyaline or myelin-like cytoplasmic inclusions appearing in some tissue sections of the highest treatment levels; and lipidosis. Histological changes in testes of treated rats were less obvious than lesions observed in the liver. There was a loss of staining intensity of the seminiferous tubules associated with hypocellularity of the tubules. Decreased spermatogenesis was evident in three rats from the high dose groups. Both compounds produced detectable histological changes in the thyroid glands at the 75 ppm treatment level. There did not appear to be any consistently significant differences between the toxic effects, either qualitative or quantitative, of mirex and 8-monohydromirex in rats fed either compound for 28 days. (Author abstract by permission)

81-2041. Mehendale, H. M. (Dep. Pharmacol. & Toxicol., Univ. Mississippi Med. Cent., Jackson, MS 39216) **Onset and recovery from chlordecone- and mirex-induced hepatobiliary dysfunction.** *Toxicol. Appl. Pharmacol.* 58(1): 132-139; 1981 (18 references).

Male Sprague-Dawley rats were maintained on diets containing uniformly mixed chlordecone (CD, 100 ppm) or mirex (M, 100 ppm). Control groups received similarly prepared diets without CD or M. Daily food consumption and body wt were monitored. Chlordecone treated animals exhibited tremors and hyperexcitability and mirex groups exhibited diarrhea and lethargy by day 8 of treatment. Every 5th day, groups of 3-5 animals were surgically prepared to measure biliary excretion of phenolphthalein glucuronide (PG). Biliary excretion of PG was suppressed within 10 days by both CD and M and maximal hepatic excretory dysfunction occurred by day 25 for M and day 35 for CD. Serum transaminase enzymes (SGOT and SGPT) were not significantly elevated. Significant liver enlargement was seen throughout the treatment period in both groups. During the onset of hepatic dysfunction a significant hepatic functional rebound effect was seen in the case of animals treated with CD. Livers were enlarged and total volume of bile secretion increased, M being more potent in this regard than CD. CD residues were higher in the liver and bile samples compared to M. After maximal hepatic dysfunction, animals were transferred to control diets and the above parameters were monitored during the recovery phase. It appears that onset of hepatic dysfunction is more rapid with M and recovery slower in comparison to CD induced hepatic dysfunction. Since higher levels of CD were found in the liver than M the differences between CD and M induced impairment of hepatobiliary dysfunction were more closely related to their intrinsic physicochemical properties than dispositional differences. The levels of M and CD in the liver tissue were closely related to the extent of hepatobiliary dysfunction induced by these chemicals. (Author abstract by permission)

81-2042. Suzuki, K.; Lee, I. P.* (Lab. Reprod. & Dev. Toxicol., NIEHS, Research Triangle Park, NC 27709) **Induction of aryl hydrocarbon hydroxylase and epoxide hydrolase in rat liver, kidney, testis, prostate glands, and stomach by a potent nematocide, 1,2-dibromo-3-chloropropane.** *Toxicol. Appl. Pharmacol.* 58(1): 151-155; 1981 (20 references).

Because of environmental contamination with 1,2-dibromo-3-chloropropane (DBCP), a potent nematocide, it has become necessary to assess its adverse biological effects. The present data described the ability of DBCP to induce aryl hydrocarbon hydroxylase (AHH) and epoxide hydrolase (EH) activities in the liver, kidney, testis, prostate glands, and stomach of the male rat. DBCP induced AHH in all organs studied except the liver and prostate glands. Maximum induction of AHH appeared 8, 8, and 16 hr following treatment for stomach, kidney, and testis, respectively. At the maximum induction, AHH activity in testis, kidney, and stomach was 2.1, 3.8, and 4.7 times that of controls, respectively. EH activity was also induced at varying times following DBCP treatment in the liver, kidney, testis, and prostate glands. The maximum induction occurred at 48 hr in kidney and testis, and at 74 hr in liver and prostate glands. At the maximally induced state, EH activity in prostate, testis, kidney, and liver was 2.3, 1.4, 1.9 and 2.6 times that of controls, respectively. Thus, EH induction was slightly less than that of AHH in respective organs. Furthermore, DBCP induction of AHH and EH activity was inhibited by either actinomycin D or cycloheximide, suggesting that this enzyme induction is due to *de novo* synthesis of new hemoproteins. (Author abstract by permission)

81-2043. Helder, T. (Dep. Spec. Anim. Pathol., State Univ. Utrecht, NL-3572 BP Utrecht, The Netherlands) **Effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) on early life stages of rainbow trout (*Salmo gairdneri*, Richardson).** *Toxicology* 19(2): 101-112; 1981 (31 references).

2,3,7,8-Tetrachlorodibenzo-*p*-dioxin was used at concentrations of 10, 1, and 0.1 ppt in experiments with rainbow trout eggs, exposed over 24 wk. In a second experiment, 500 newly hatched trout fry were exposed to 1.0 ppt TCDD for 96 hr. In a third experiment triplicate groups of 25 juvenile rainbow trout were exposed to 10 or 100 ppt TCDD for 16/hr/day for 4 consecutive days. Egg development time was not affected by TCDD treatment. While the mode of hatching was not changed, the larvae exposed to 10 ppt TCDD were retarded in development. At higher concentrations significant numbers of fry developed generalized edemas and died. Degeneration and necrosis of the liver parenchymal cells were noted. Teratologic changes such as fore-shortened maxillas and opercular defects were noted among the remaining fry. TCDD administered to the yolk sac produced similar effects. Growth retardation and slight edematous changes were noted in juvenile rainbow trout exposed to 10 ppt TCDD for 96 hr. At 100 ppt all fry died within 27 days.

81-2044. Van der Heijden, C. A.; Den Tonkelaar, E.; Garbis-Berkvens, J. M.; Van Esch, G. J. (Lab. Toxicology, Natl. Inst. Public Health, Bilthoven, The Netherlands) **Maleic hydrazide, carcinogenicity study in rats.** *Toxicology* 19(2): 139-150; 1981 (24 references).

SPF derived Wistar rats were fed diets containing maleic hydrazide at levels of 1.0 and 2.0% for 28 mo. An initial reduction in growth in female rats given both concentrations was noted. The histopathology and wt of the kidneys at 12 and 28 mo did not reveal any abnormality. The kidneys appeared to be the target organ and levels of 1.0% and higher induced renal dysfunction. Tumor incidence, tumor type, and age of tumor associated with mortality did not differ between controls and treated groups. A lack of tumor-inducing activity was also demonstrated in mice carcinogenicity studies. The 1.0% level caused functional abnormalities in the kidneys, and cannot be regarded as a no-effect level.

81-2045. Rao, T. N.; Subrahmanyam, D. (Dep. Biochem., Postgrad. Inst. Med. Educ. & Res., Chandigarh 160012, India) **Effect of DDT on adipose tissue lipolysis in rat.** *Toxicology* 19(2): 151-158; 1981 (15 references).

The effects of acute and chronic exposures of albino rats to DDT on the lipolytic response of adipose tissue were investigated. Male albino rats were fed 600 mg/kg of DDT for the acute, single dose exposure study. For the chronic study rats were fed DDT at 15 mg/kg/day for 45 days. Lipolysis in intact fat pads was not changed by DDT feeding in acute or chronic dose schedules. Levels of fatty acids in the sera were also unchanged. Lipolysis was stimulated when noradrenaline was present in the incubation system. Addition of DDT along with noradrenaline to the medium did not affect the rate of lipolysis. Typical neurotoxic symptoms were noted with the acute oral dose. Rats receiving chronic exposure treatments did not show any adverse symptoms and their growth rates were not affected. The data suggest that DDT in adipose tissue may not affect the lipolytic activity of the adipocyte and the energy required for coping with the toxicity of DDT may be derived more from glucose, which may arise from increased gluconeogenic activity in liver and kidney.

81-2046. Debets, F. M. H.; Reinders, J. H.; Bedets, A. J. M.; Loessbroek, T. G.; Strik, J. J. T. W. A.; Koss, G. (Dep. Toxicol., Agric. Univ., Wageningen, The Netherlands) **Biotransformation and porphyrinogenic action of hexachlorobenzene and its metabolites in a primary liver cell culture.** *Toxicology* 19(3): 185-196; 1981 (27 references).

The biotransformation of hexachlorobenzene (HCB) was investigated in primary cultures of chick embryo liver cells in order to determine whether the liver culture system resembles, in all respects, the animal model. The results indicated that the biotransformation of HCB fulfilled an essential role in the onset of porphyria. Since

none of the major HCB-metabolites could induce a pathological porphyrin pattern, a reactive intermediate capable of reacting with the glutathione or thiol-groups of uroporphyrinogen decarboxylase is probably responsible for the inhibition of uroporphyrinogen decarboxylase. The chick embryo liver cell system may be useful and sensitive as a system for studying the metabolism of xenobiotics in relation to their toxicity.

81-2047. Smith, L. L.; Wyatt, I.; Rose, M. S. (Cent. Toxicol. Lab., ICI Ltd., Alderly Park, Cheshire SK10 4TJ, England) **Factors affecting the efflux of paraquat from rat lung slices.** *Toxicology* 19(3): 197-207; 1981 (9 references).

Several chemicals were examined for their ability to increase the rate of efflux of paraquat from the lung. This efflux was found to be biphasic, having both a very fast and a slow component. The slow component was first order and was characterized by a half-life of 17 hr. Lung slices, prepared from rats dosed iv with paraquat, were incubated in the presence of iodoacetate at 1 m*M* concentration, and demonstrated a reduction of the half-life to ~ 3 hr. In the presence of rotenone at 100 μM concentrations, this half-life was reduced to about 9 hr. Histamine, at 100 μM and promethazine, at 100 μM, did not change the efflux of paraquat from lung slices. Bromothymol blue, a dye which forms ion pair complexes with paraquat, also significantly increased the efflux of paraquat from lung slices. However, bromthymol blue effects lessened with the passage of time and thus, paraquat efflux in the presence of bromothymol blue did not obey first order kinetics. It was concluded that the reduction in the accumulation of paraquat produced by metabolic inhibitors may be a consequence of lung cell damage, that bromothymol blue and putrecine caused an increase in paraquat efflux without damaging the tissue, and that histamine and promethazine reduced the uptake of paraquat by direct competition with paraquat as they neither increase the efflux rate nor reduced cellular viability.

81-2048. Koenemann, H. (Minist. Health & Environ. Prot., NL-2260 AK Leidschendam, The Netherlands) **Quantitative structure-activity relationships in fish toxicity studies. Part I: relationship for 50 industrial pollutants.** *Toxicology* 19(3): 209-221; 1981 (35 references).

Guppies were exposed to 72 industrial pollutants (including many pesticides) in an attempt to establish quantitative structure-activity relationships to complement information previously obtained from toxicity studies. Particularly, the correlation of LC50s with several expressions of the hydrophobicity of these chemicals was investigated. Calculated log P_{oct}-values appeared to be more reliable than HPLC retention indices, solubility data or molecular connectivity indices. One quantitative structure-activity relationship (QSAR), with log P_{oct} as the only variable, gave good estimations of the toxicities of most of the compounds possessing log $P_{oct} < 6$. No LC50 could be calculated for solutions of compounds with log $P_{oct} > 6$. The use of water solubilities in these QSARs is only possible for slightly soluble compounds. Another disadvantage is the absence of a reliable calculation procedure.

81-2049. Koenemann, H.; Musch, A. (Minist. Health & Environ. Prot., NL-2260 AK Leidschendam, The Netherlands) **Quantitative structure-activity relationships in fish toxicity studies.** *Toxicology* 19(3): 223-228; 1981 (19 references).

Tabata's theory concerning the influence of pH on the toxicity of ammonia to aquatic organisms was used as a basis to study the toxicity of 11 chlorophenols to fish. Data indicate that the toxicity of the chlorophenols increases with decreasing pH. The toxicities of 11 chlorophenols to guppies was determined at 3 pH values and calculated by this formula at another pH. Quantitative structure-activity relationships (QSARs) could then be calculated for the LC50 at each of these pH values.

81-2050. Konemann, H. (Dep. Vet. Pharmacol. & Toxicol., Univ. Utrecht, NL-3572 BP Utrecht, The Netherlands) **Fish toxicity tests with mixtures of more than two chemicals: a proposal for a quantitative approach and experimental results.** *Toxicology* 19(3): 229-238; 1981 (28 references).

The problems involved in toxic actions brought about by mixtures of many chemicals was investigated. The terminology and classification of toxic mixtures of 2 chemicals cannot be used for mixtures of more than 2 chemicals; the use of the Mixture Toxicity Index (MTI) is recommended. The MTI is a logarithmic function which gives, independent of the number of compounds in the mixture and the ratio between the concentrations, a constant value for the reference points of no addition and concentration addition. Several mixtures of chlorinated aromatics and pesticides were used to determine these relationships. Compounds whose toxicity can be described with a quantitative structure-activity relationship (QSAR) do show concentration addition, in contrast to mixtures with dissimilar action. In a mixture of 50 hydrophobic chemicals, concentrations of 0.02 times the LC50 were shown to be additive. It is postulated that the site of action of hydrophobic compounds is a general site, and that hydrophobic compounds in mixtures contribute to the toxicity.

81-2051. Rath, S.; Misra, B. N. (Lab. Environ. Toxicol., Dep. Bot., Berhampur Univ., Berhampur 760007, India) **Toxicological effects of dichlorvos (DDVP) on brain and liver acetylcholinesterase (AChE) activity of *Tilapia mossambica*, Peters.** *Toxicology* 19(3): 239-245; 1981 (15 references).

Interactions between dichlorvos and aging on brain and liver cholinesterase activity of *Tilapia mossambica* Peters are reported. A significant negative correlation was noted between body wt and AChE activity in the exposed fish. The enzyme activities of brain AChE were comparatively higher than those of the liver. Remarkable inhibition of brain and liver AChE activities was seen in exposed fish of all sizes. The degree of inhibition increased with increased concentrations of dichlorvos. Maximum inhibition of brain (68%) and liver (49%) AChE activities was demonstrated in small fish exposed to 1.25 mg/l dichlorvos for 15 days. Larger fish demonstrated 50 and 48% brain and liver AChE inhibitions, respectively, under similar exposure situations. Small fish, at 7 day exposures, recovered AChE activity of brain and liver by 89 and 98%, respectively, within 1 wk, while large fish acquired only 8% and 7%, respectively, of the initial brain and liver activities.

81-2052. Klaassen, C. D. (Sch. Med., Univ. Kansas, Kansas City, KS) **Absorption, distribution, and excretion of toxicants.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH03: 28-55; 1980 (154 references).

The concentration of toxic chemicals in the human body is a function of exposure, adsorption, distribution within the body, metabolism (biochemical transformation) and excretion. Adsorption is the process by which toxicants pass through body membranes and enter the bloodstream. The major routes of absorption are the lungs, gastrointestinal tract, and skin; these major routes as well as special routes of administration used in toxicologic studies (ip, sc, im and iv) are discussed in detail. The movement of toxicants through cell membranes by passive transport and special transport mechanisms is also described. Distribution of the toxicant occurs after it enters the plasma. Volume of distribution, storage of toxicants in tissues, plasma proteins as a storage depot for toxicants, high concentrations of toxicants in the liver and kidney, fat as a storage depot for toxicants (including DDT, chlordane and PCBs), bone as a storage depot for toxicants, the blood-brain barrier, passage of toxicants across the placenta, and redistribution of toxicants are discussed. The kidney is concluded to be the most important excretory organ in the body. However, other excretory routes are also suggested to be important. For example, DDT and lead are also excreted by the liver and biliary system. Biliary excretion, urinary excretion, and other excretory routes, including the lung, gastrointestinal tract, cerebrospinal fluid, and sweat and saliva, are described. Pharmacokinetics, the quantitative study of the metabolic processes of absorption, distribution, biotransformation, and elimination, is also considered in detail.

81-2053. Neal, R. A. (Sch. Med., Vanderbilt Univ., Nashville, TN) **Metabolism of toxic substances.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH04: 56-69; 1980 (10 references).

The qualitative metabolism of toxic substances is discussed. A number of enzymes and enzyme systems are present in animal bodies which catalyze metabolic reactions involving foreign compounds. In most cases these enzymes render the original compound less toxic. However, in some instances the metabolites are more toxic than the parent compound. There are also wide species and strain differences in the rates of metabolism of foreign compounds that contribute to their different responses to the same toxic compound. Variables that affect metabolism include the rate of absorption, transfer across cell membranes, protein binding, excretion, species, strain, sex, the effect of age on metabolism of foreign compounds, circadian rhythms, nutritional status, and enzyme induction. It is suggested that an understanding of the metabolic disposition of a foreign chemical in any animal species may explain the toxic effect of that chemical in that species.

81-2054. Doull, J. (Sch. Med., Univ. Kansas, Kansas City, KS) **Factors influencing toxicology.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH05: 70-83; 1980 (24 references).

Various factors influence chemical toxicity. These factors are classified as factors related to the toxic agent itself, factors related to the exposure situation, or factors related to the subject exposed. Factors related to the toxic agent include chemical composition, physical characteristics, presence of impurities or contaminants, stability and storage characteristics, solubility of the toxic agent in biologic fluids, choice of the vehicle, and the presence of additional compounds including emulsifiers, surfactants, and binding agents. Factors related to the exposure situation include dose, concentration, and volume administered; route, rate and site of administration; duration and frequency of exposure; time of administration such as season, or time of day. Factors related to the subject include both inherent features and environmental conditions. Inherent features include genetics status, species and strain, immunologic status, nutritional state, hormonal status, age, sex, body wt, maturity, central nervous system status, or the presence of disease or specific organ damage. Environmental factors include temperature, humidity, barometric pressure, ambient atmospheric composition, light and other radiation, housing and caging effects, noise and other geographic influences, social factors and chemical factors.

81-2055. Weisburger, J. H.; Williams, G. M. (Naylor Dana Inst. Dis. Prev., Am. Health Found., Valhalla, NY) **Chemical carcinogens.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH06: 84-138; 1980 (149 references).

Chemical carcinogens are defined operationally by their ability to induce tumors. Four types of response have been accepted as evidence of tumorigenicity: an increased incidence of the tumor types occurring in controls; the occurrence of tumors earlier than in controls; the development of types of tumors not seen in controls; and increased multiplicity of tumors in individual animals. The mode of action of chemical carcinogens is described; evidence that DNA is a critical target for carcinogens is presented. Classes of chemical carcinogens discussed include direct acting or primary carcinogens which includes halo ethers, other active halogen compounds, and nitrosamides and nitrosoureas; and procarcinogens or secondary carcinogens including polycyclic or heterocyclic aromatic hydrocarbons, aromatic amines, azo dyes, nitrosamines, nitrosamides, symmetric dialkylhydrazines, dioxane, benzene, thioamides, urethane, ethionine, carbon tetrachloride and related halohydrocarbons, and microbiologic carcinogens. The metabolism of chemical carcinogens, reactions of chemical carcinogens, modifying factors in chemical carcinogenesis, and the bioassay of chemical carcinogens are also discussed.

81-2056. Harbison, R. D. (Sch. Med., Vanderbilt Univ., Nashville, TN) **Teratogens.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH08: 158-175; 1980 (101 references).

Chemical agents that cause defects in organ systems during embryonic development are called teratogens. Susceptibility to teratogenic agents varies with the developmental stage of the fetus at the time of exposure. Sensitive periods for development of orofacial, eye, limb, CNS, skeletal, or kidney defects are presented in tabular form. Chemically induced teratogenic effects are dose related. Classes of cytotoxic teratogens include antimetabolites, intercalating agents, amino acid antagonists and spindle poisons. Genetic factors may also influence teratogenesis. Pathogenesis, teratogenic mechanisms, genetic factors influencing teratogenesis, human teratogenesis, and types of teratogens are discussed. Substances known to be teratogens in animal models, including insecticides, fungicides and herbicides, are listed.

81-2057. Norton, S. (Sch. Med., Univ. Kansas, Kansas City, KS) **Toxic responses of the central nervous system.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH09: 179-205; 1980 (196 references).

Toxic responses of the central nervous system are examined. Structural and functional toxicity are considered. Six types of nervous system toxicants are discussed. Anoxia is caused by barbiturates, carbon monoxide, cyanide, azide and nitrogen chloride. Agents causing damage to myelin include hexachlorophene, lead and thallium. Organophosphorus compounds cause peripheral axonopathies. Several episodes of serious poisoning have occurred from unintentional contamination of food by TOCP. Delayed neurotoxicity has been shown to occur in poisoning from DFP, leptofos, and mipafox. Related insecticides, such as parathion and malathion, and carbamate anticholinesterase insecticides, have not been shown to cause neuropathies. Agents causing primary damage to perikarya of peripheral neurons include organomercury compounds. Organomercury compounds more readily affect the sensory cell bodies in the dorsal root ganglion of the spinal cord because of the lack of a blood barrier such as exists over much of the brain capillaries. Neuromuscular junctions of motor nerves are affected by DDT, allethrin and lead. DDT and other similar insecticides caused repetitive firing of the motor end plate through repeated depolarizations of the presynaptic nerve terminal. Repetitive discharge occurs in sensory, central, and motor neurons in DDT poisoned insects. Pyrethrum induces various nervous system effects. Allethrin has effects resembling DDT, causing repetitive firing of the motor end plate. Neurotoxicants causing localized CNS lesions include DDT and mercury.

81-2058. Hook, J. B. (Michigan State Univ., East Lansing, MI) **Toxic responses of the kidney.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH11: 232-245; 1980 (41 references).

Renal physiology and pathophysiology are discussed. Specific nephrotoxins, including heavy metals (mercury, chromium), halogenated hydrocarbons, therapeutic agents, and environmental pollutants, [pesticides, herbicides (2,4,5-T and paraquat) TCDD and PCBs] are considered. Organic mercury compounds produce renal damage in both man and animals. Functional toxicity probably results from both vasoconstriction and direct cellular effects. Mitochondrial injury does not play a primary role in the pathogenesis of mercury toxicity. The mitochondrial damage occurs only at about the same time as general disruption of the plasma membrane occurs. A variety of pesticides and herbicides have reached sufficient concentrations in the environment to constitute potential hazards to man and animals. It is suggested that 2,4,5-T may influence renal function. Paraquat produces profound pulmonary damage following acute intoxication; after high doses it causes direct renal damage. Renal damage caused by TCDD and PCBs is also noted.

81-2059. Menzel, D. B.; McClellan, R. O. (Med. Cent., Duke Univ., Durham, NC) **Toxic responses of the respiratory system.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH12: 246-274; 1980 (85 references).

A general introduction to inhalation toxicity is presented. The structure of the respiratory tract and pulmonary physiology are considered. The response of the respiratory system to gases, vapors and particulates is discussed. The discussion of pulmonary response to specific toxicants is divided into 5 areas; direct airway irritation, cellular damage and edema (caused by paraquat), production of fibrosis, induction of allergic response, and production of pulmonary cancer. Principal industrial toxicants producing lung disease through inhalation, and the site of action and pulmonary disease produced by selected occupationally inhaled toxicants, are presented in tabular form.

81-2060. Dixon, R. L. (Lab. Environ. Toxicol., NIEHS, Research Triangle Park, NC) **Toxic responses of the reproductive system.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH15: 332-354; 1980 (18 references).

General reproductive biology and general pharmacologic and toxicologic principles are presented. Experimental results have indicated that a large number of chemicals can affect male and female reproduction. Among the insecticides that have been shown to affect male reproduction are organochlorine derivatives such as DDT, dieldrin, chlordane, benzene hexachloride (BHC), and chlordecone (Kepone); and organophosphates and carbamates (carbaryl). Other pesticides shown to be harmful in this manner include herbicides such as chlorinated phenoxyacetic acids, paraquat and diquat; dithiocarbamate fungicides; and the fumigants ethylene dibromide and DBCP. Organophosphates and carbamates have also been shown to damage the female reproductive system. In general the damage to gonads and their function results from direct actions of the chemicals on germ cells without apparent influence on endocrine glands, actions affecting the accessory secretions of prostate and seminal vesicles in the male, or inhibition of overall hormonal controlling mechanisms at either the gonads or hypothalamic-pituitary level.

81-2061. Hammond, P. B. (Coll. Med., Univ. Cincinnati, Cincinnati, OH) **Metals.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH17: 409-467; 1980 (205 references).

Factors influencing the toxicity of metals, metal chelation, the toxic effects of metals and acquired tolerance to metals are considered. The elemental nature of metals and their diverse affinities for organic ligands in biologic structures are characteristics that discourage generalizations of their behavior in the human body. The critical organ and critical dose concepts have evolved in connection with metal toxicity to a greater degree than with other toxicants. The toxicity characteristics of 42 metals are presented. The use of metals in insecticides and fungicides is discussed. The major uses of arsenic include insecticides, week killers, and wood preservatives. Barium fluorosilicate and carbonate have been used as insecticides. Copper sulfate mixed with lime has been used as a fungicide. Ferbam is an iron-containing fungicide. Selenium has been used in fungicides, insecticides, and as an insect repellent. Thallium compounds, chiefly thallous sulfate, have been used as rodenticides and insecticides. Organic tin compounds have been used as fungicides. Vanadium has been used in the manufacture of insecticides. Zinc chloride has been used as a wood preservative due to its fungicidal activity.

81-2062. Rumack, B. H.; Peterson, R. G. (Rocky Mtn. Poison Cent., Denver, CO) **Clinical toxicology.** In: *Toxicology: The Basic Science of Poisons.* Doull, J., Klaassen, C. D. and Amdur, M. O., eds. (Macmillan Publ. Co. Inc.: NY): CH27: 677-698; 1980 (86 references).

Principles of clinical management, specific current theory and treatment of frequently encountered toxic situations are reviewed. In cases of chlorinated hydrocarbon poisoning, the organic solvent used as a vehicle for the chemical is frequently as toxic as the pesticide active ingredient. Many of the chlorinated hydrocarbon insecticides are rapidly absorbed and produce central nervous system toxicity. Hepatotoxicity, renal toxicity and mycardial toxicity may also occur. Clinical manifestations of poisoning include apprehension, agitation, vomiting, gastrointestinal upset, abdominal pain and CNS depression. Organophosphate insecticides are potent cholinesterase inhibitors. Clinical effects include muscarinic effects, nicotinic effects, headache, weakness, dizziness, blurred vision, psychosis, respiratory difficulty, paralysis, convulsions and coma. Carbamate insecticides are reversible inhibitors of cholinesterase. Clinical manifestations are similar, but not identical to, symptoms of organophosphate poisoning; they include headache, blurred vision, weakness, sweating, myosis, chest pain or tightness, salivation, lacrimation, nausea, vomiting, urination, abdominal cramps and diarrhea.

81-2063. Mount, M. E.; Oehme, F. W. (Comp. Toxic. Labs., Kansas State Univ., Manhattan, KS 66506) **Insecticide levels in tissues associated with toxicity: a literature review.** *Vet. Hum. Toxicol.* 23(1): 34-42; 1981 (59 references).

A literature review of studies and reports on residues in proven or suspected insecticide poisonings or exposures is presented. The importance of differentiation between background levels and tissue concentrations associated with acute exposures is considered. Numerous studies of organochlorine insecticide poisoning are presented. The brain is suggested to be a reliable tissue for

determination of organochlorine residues. The organochlorines discussed include DDT, DDD (TDE), DDE, endosulfan, endrin, heptachlor, chlordane, lindane and toxaphene. Studies of organophosphate insecticide poisoning may involve measurement of insecticide residues, metabolites, or inhibition of cholinesterase (ChE) activity. Metabolite determination and identification is considered to be necessary because metabolic activation is required for some organophosphate insecticides. Instances of organophosphate poisoning presented include carbophenothion, diazinon, phorate and ronnel toxicity. No studies of carbamate insecticide residues in tissues were found.

81-2064. Mukhamedzhanov, E. K.; Apsatarova, R. A.; Ionina, M. P. (Lab. Biochem. Nutr., Kazakh Branch, Inst. Nutr., Alma-Ata, USSR) **O vliyanii nekotorykh fosfororganicheskikh pestitsidov na okislitel'nyi metabolizm na fone sbalansirovannogo i ne sbalansirovannogo po belku ratsiona. [Effect of certain organophosphorus pesticides on oxidative metabolism depending upon the balanced and nonbalanced protein diet.]** *Vopr. Pitan.* (1): 56-60; 1981 (17 references) (Russian).

The effect of the pesticides chlorofos (trichlorfon) and trichlorometafos- 3 on oxidative metabolism were studied in albino rats kept on a balanced or nonbalanced protein diet. Pesticides were injected im at 0.1 LD% after animals had been kept on a diet for 30 days. Administration of organophosphorus pesticides was found to increase activity of glycolytic enzymes and serum cholinesterase in animals kept on a nonbalanced protein diet.

81-2065. Ashton, P. J.; Scott, W. E.; Steyn, D. J. (Natl. Inst. Water Res., Counc. Sci. & Ind. Res., Pretoria 0001, Republic of South Africa) **The chemical control of the water hyacinth (*Eichhornia crassipes* (Mart.) Solms).** *Water Sci. Technol.* 13(2): 865-882; 1981 (35 references).

A case of the effects of controlling water hyacinth with the herbicide terbutryn is described. An infestation of the plant was treated with Clarosan 500 FW (terbutryn) at a mean concentration of 86.5 g/kg. The water levels of the herbicide were consistently low. The fish *Clarias gariepinus* accumulated the herbicide for a short time after the treatment. Four days after treatment levels reached 1.8 mg/kg in liver and 9.4 mg/kg in fat. Muscle contained 1.5 mg/kg after 10 days. After 10 days levels began to decrease.

See also 81-1802, 81-1804, 81-1805, 81-1806, 81-1807, 81-1810, 81-1813, 81-1814, 81-1815, 81-1816, 81-1829, 81-1830, 81-1831, 81-1832, 81-1834, 81-1835, 81-1836, 81-1837, 81-1838, 81-1841, 81-1842, 81-1843, 81-1844, 81-1845, 81-1846, 81-1847, 81-1848, 81-1849, 81-1850, 81-1851, 81-1858, 81-1859, 81-1861, 81-1863, 81-1867, 81-1874, 81-1878, 81-1893, 81-1895, 81-1896, 81-1898, 81-1899, 81-1910, 81-1911, 81-1912, 81-1914, 81-1915, 81-1916, 81-1917, 81-1921, 81-1922, 81-1926, 81-1931, 81-1932, 81-1934, 81-1935, 81-1938, 81-1939, 81-1940, 81-1941, 81-1942, 81-2080 *and* 81-2081.

81-2066. Anderson, C. C.; Gunderson, E. C.; Coulson, D. M. (SRI Int., Menlo Park, CA 94025) **Sampling and analytical methodology for workplace chemical hazards.** *ACS Symp. Ser.* 149: 3-19; 1981 (4 references).

Research in the field of industrial hygiene sampling and analysis is reviewed. The detection and identification of low levels of chemicals resulting in an increased understanding of the extent of toxic material contamination in workplaces and the environment. A detailed protocol for laboratory validation of sampling and analytical methods for toxic substances is suggested, along with considerations for selection of a method of sampling and analysis. General methods employed in detecting hazardous chemicals are discussed. Much research has been directed toward the development of a universal filter/sorbent sampling train for pesticides. Where possible a 37-mm MCE filter followed by a sorbent tube containing 20/40 mesh Chromosorb 102 is used. The filter and sorbent are then combined and the pesticide dissolved in toluene. Analysis of this solution by GC with an appropriate detector found the method to be suitable for endrin, chlordane and ronnel. Methods for Phosdrin (mevinphos), TEPP, and heptachlor use a Chromosorb 102 sorbent only. A method was validated for demeton using an MCE filter/XAD-2 sampling train. Validated methods are also available for ANTU, 2,4-D, paraquat, pyrethrum, rotenone, 2,4,5-T, thiram and warfarin.

81-2067. Boyd, K. W.; Emory, M. B.; Dillon, H. K. (South. Res. Inst., Birmingham, AL 35255) **Development of personal sampling and analytical methods for organochlorine compounds.** *ACS Symp. Ser.* 149: 49-64; 1981 (18 references).

Work performed under contract with NIOSH to develop and validate sampling and analytical methods for 3 potentially toxic chlorinated organic compounds, hexachlorocyclopentadine (HCCP), hexachlorobutadiene (HCBD), and 1,2-dichloropropane (1,2-DCP), is described. The methods developed for each of these compounds involve the collection of vapors from air with solid sorbents in tandem with personal sampling pumps, desorption of the sorbed compounds in appropriate solvents, and the analysis of the extracts by gas chromatography. The development of the method is discussed including the optimization and calibration of analytical procedures, and the selection of collection media. Validation of the method is presented, including information on determination of the LAQL, determination of long-term stability of sorbed analyte, and the determination of accuracy and precision of the overall sampling and analytical procedure.

81-2068. Houk, C. C.; Beaulieu, H. J. (Dep. Chem., Ohio Univ., Athens, OH 45701) **Sampling and breakthrough studies with Plictran.** *ACS Symp. Ser.* 149: 109-121; 1981 (12 references).

This study tested combinations of glass fiber, cellulose ester filters and HNO impingers for breakthrough of Plictran (cyhexatin). Glass fiber and cellulose ester filters were studied in 2 configurations. One involved direct contact in 2 piece 37 mm field cassettes and the other involved separation in 3 piece 27 mm field cassettes. In both configurations regular filters and filters coated with $CuCl_2$-$4NH_3$ were tested. Plictran was effectively collected with a filter without relying on HNO_3. A single, uncoated glass fiber filter was sufficient to collect Plictran, since breakthrough from the filters was not a problem. Coated filters were not more effective than uncoated. Coated filters did increase air flow resistance which subsequently reduced the sampling flow rate that could be employed.

81-2069. Gunderson, E. C.; Fernandez, E. L. (SRI Int., Menlo Park, CA 94025) **Solid sorbents for workplace sampling.** *ACS Symp. Ser.* 149: 179-193; 1981 (6 references).

In efforts to provide validated sampling and analytical methods for determining worker exposure to toxic substances, existing methods were validated when possible and new procedures were developed and validated when no methods were available. Commercially available charcoal tubes are typical of the solid sorbent tubes used to sample a workplace environment. Characteristics of the commonly used sorbents are described. Over 130 methods have been validated using coconut, petroleum, synthetic charcoal, silica gel, Florisil, alumina, and molecular sieves as sorbents. Information about the physical properties, chemical properties, reactivity, and interferences possessed by the substance to be collected is also required. Substances for which charcoal methods have been validated are presented in tabular form, including *o*-dichlorobenzene, *p*-dichlorobenzene, epichlorohydrin and ethylene dibromide. Porous polymer methods have been validated for numerous compounds, including Tenax-GC for diphenyl (biphenyl) and chromosorb 102 for Phosdrin (mevinphos) and heptachlor.

81-2070. Gunderson, E. C. (SRI Int., Menlo Park, CA 94025) **Sampling methods for airborne pesticides.** *ACS Symp. Ser.* 149: 301-315; 1981 (13 references).

Personal sampling and analytical methods were developed and validated in the laboratory for determining workplace exposure to numerous pesticides. The major objectives were to standardize specific sampling media and to develop and validate methods using filter/sorbent sampling trains. Criteria which must be met by a good sampling device are briefly listed. It is concluded that > 90% of the pesticide should be recoverable from the sampling device, the sampler should collect the sample efficiently and have adequate capacity, collected samples should be stable on the device for at least 7 days, and the sampling media should not interfere with good precision and accuracy of

the overall method. Filters composed of glass fiber, mixed-cellulose ester, and polytetrafluoroethylene materials were studied in addition to XAD-2 and Chromosorb 102 solid sorbents. A combination filter/sorbent sampling train was also studied. Filter sampling methods were developed for ANTU, paraquat, pentachlorophenol (PCP), pyrethrum, rotenone, strychnine, 2,4-D, 2,4,5-T, thiram, warfarin and sodium fluoroacetate. Sorbent methods were developed for heptachlor, Phosdrin (mevinphos), TEPP and dichlorvos. Filter/sorbent methods were developed for chlordane, demeton, endrin and ronnel. Sampling devices were chosen based on compatibility with the analytical methods and the specific substances' physical and chemical properties. Samples were collected from dynamically generated test atmospheres of each pesticide over a known concentration range and analyzed to test the overall methods. Criteria were developed for testing pesticides that have significant vapor and particulate contributions at workplace concentrations.

81-2071. Becher, G.; Bjorseth, A.; Olufsen, B. (Cent. Inst. Ind. Res., Oslo 3, Norway) **Application of glass capillary gas chromatography for determination of potential hazardous compounds is workplace environments.** *ACS Symp. Ser.* 149: 369-381; 1981 (33 references).

The application of gas chromatography for determination of potential hazardous compounds in workplace environments was investigated. The use of different glass capillary columns and different detector systems is also discussed. Gas chromatographic methods are characterized by high resolution and good sensitivity and may be used for analyzing different groups of pollutants with varying chemical properties. By modification of the inner glass surface, the column may be tailored to the chemical properties of the pollutants to be analyzed. The use of both general and selective detectors provides additional information about the sample composition. The method may be applied to samples of air as well as body fluids. Aromatic amines are used as intermediates in the synthesis of numerous compounds including pesticides. Their analysis presents a problem because these basic, polar compounds may lead to adsorption on the glass surface causing severe tailing of peaks or even loss of the component. A basic, polar glass capillary column suitable for these chemicals was developed. Aromatic amines are frequently found as minor components in a complex mixture of other contaminants; therefore it was also necessary to apply nitrogen-selective detection using a flameless alkali-sensitized detector.

81-2072. Ricci, G.; Colovos, G.; Hester, N.; Shepard, L. S. (Environ. Monit. & Serv. Cent., Rockwell Int., Newbury Park, CA 91320) **Suitability of various filtering media for the collection and determination of organoarsenicals in air.** *ACS Symp. Ser.* 149: 383-399; 1981 (12 references).

Studies conducted for the selection of an appropriate filtering medium and the evaluation of the combined sampling and analysis methods for the collection and determination of organoarsenicals in air are described. An enclosed sampling train for generation and quantitative collection of vapors was assembled. Three filtering media commercially available were evaluated for the collection of airborne particulates of the organoarsenical compounds: cellulose ester membranes, Fluoropore and Mitex. The percent recoveries of dimethylarsenic acid (DMA; cacodylic acid) from either filter type were 94.4-104.0%; no stability problem was noted. The recoveries of monomethylarsonic acid (MMA; MAA) and *p*-aminophenylarsonic acid (*p*-APA) from cellulose ester filters which were stored 3 days before extraction and analysis were 62-78%. Recoveries of MMA and *p*-APA from cellulose ester filters were significantly better if the filter samples were extracted the same day. Removal of the undissolved cellulose ester filter material from aqueous extracts did not improve the stability of the organoarsenicals.

81-2073. Vantulder, P. J. M.; Howard, C. C.; Riggin, R. M. (Battelle-Columbus Lab., Columbus, OH 43201) **High performance liquid chromatographic determination of aromatic amines in body fluids and commercial dyes.** *ACS Symp. Ser.* 149: 413-427; 1981 (9 references).

Various halogenated and nitrated aniline derivatives are used in the manufacture of dyestuffs and carbamate and urea based pesticides. It is important to have reliable analytical methods for determining the degree of exposure through body fluid analysis. Cyclic voltammograms were run on a large number of aromatic amines to determine the range of aromatic amines which could be determined by HPLC/EC (electrochemical detection). The results indicated that HPLC/EC would be useful for determining aromatic diamines and halogenated anilines, but would be of little value for determining nitro-substituted anilines. Preliminary results indicate that the detection limit for the HPLC/EC method will probably be the order of 1-10 ppb, which is substantially lower than the 40 ppb detection limit reported for the gas chromatography method.

81-2074. Pankow, J. F.; Isabelle, L. M.; Barofsky, D. F. (Dep. Environ. Sci., Oregon Grad. Cent., Beaverton, OR 97006) **The identification of chlorophenoxyphenols in soil and water samples by solvent extraction and field desorption mass spectrometry.** *Anal. Chim. Acta* 124: 357-364; 1981 (10 references).

The identification of microgram amounts of chlorophenoxyphenols is shown to be possible by solvent extraction and subsequent field desorption mass spectrometry (f.d.m.s.). Although the extraction step is performed under acidic conditions, the presence of humic and fulvic materials did not interfere in the interpretation of the

f.d.m.s. spectra of soil and water samples contaminated with chlorophenoxyphenols. The pattern of oligomeric series and chlorine isotope clusters characteristic of the chlorophenoxyphenols as well as the soft-ionization properties (minimal fragmentation) of f.d.m.s. make this procedure well-suited for use in the rapid screening of liquid samples for the chlorophenoxyphenols. (Author abstract by permission)

81-2075. Rinder, D. F.; Fleeker, J. R. (Dep. Microbiol., Univ. Alabama, Birmingham, AL 35294) **A radioimmunoassay to screen for 2,4-dichlorophenoxyacetic acid and 2,4,5-trichlorophenoxyacetic acid in surface water.** *Bull. Environ. Contam. Toxicol.* 26(3): 375-380; 1981 (9 references).

Sera from three test animals were examined for immuno-reactivity with 2,4-D, 2,4,5-T, and related compounds. Three plant metabolites of 2,4-D were also tested: 2,4-dichlorophenol (DCP), 2,3-dichloro4- hydroxyphenoxyacetic acid, and 2,5-dichloro-5- hydroxyphenoxyacetic acid. All displayed low immuno-reactivity. The herbicides MCPA, 2,4-DB, and silvex exhibited greater immuno-reactivity than the metabolites but were < 10% of the 2,4-D value. 2,4,5-T showed the greatest immunoreactive response, probably due to the structure of the hapten attached to BSA. Sera were diluted in assay buffer, ^{125}I-labeled ligand was added and the mixture was incubated at 25°C for 1 hr. *Staphylococcus* cells were then added. The resulting mixture was centrifuged at 4°C for 10 min at 2000 *g* after a 10 min incubation. The pellet was resuspended, recentrifuged and then assayed by γ-scintillation for radioactivity. This assay is a screening method for 2,4-D and 2,4,5-T in surface or ground waters, however, the method cannot distinguish between the two compounds. The technique would be useful in screening large numbers of samples on a routine basis.

81-2076. Sharom, M. S.; Solomon, K. R. (Dep. Environ. Biol., Univ. Guelph, Guelph, Ontario N1G 2W1, Canada) **Adsorption and desorption of permethrin and other pesticides on glass and plastic materials used in bioassay procedures.** *Can J. Fish. Aquat. Sci.* 38(2): 199-204; 1981 (12 references).

Laboratory studies were conducted to determine the adsorption and desorption of permethrin on glass and several plastic materials that may be used for the construction of limnocorrals. The insecticide was substantially adsorbed on polyethylene, polyvinylchloride, glass, and Teflon. Adsorbed permethrin was not easily desorbed from polyethylene and polyvinylchloride by several water rinses. Increased adsorption of the insecticide was observed with increasing temperatures. A study on the adsorption of several herbicides of various water solubilities indicated that trifluralin was adsorbed to glass and that there was no general relationship between adsorption of the herbicide on polyvinylchloride and water solubility. (Author abstract by permission)

81-2077. McDuffie, B. (Environ. Res. Lab., US EPA, Athens, GA 30613) **Estimation of octanol/water partition coefficients for organic pollutants using reverse-phase HPLC.** *Chemosphere* 10(1): 73-83; 1981 (31 references).

A reverse phase HPLC technique for the estimation of the octanol/water partition coefficients of organic solutes is described. Among the 37 compounds tested by the method were triazine pesticides, methoxychlor, trifluralin, DDT, biphenyl, chlorpyrifos, fenuron, hexachlorobenzene, lindane, 1,2,4-trichlorobenzene, and trichloroethylene. The samples are eluted from a C-18 column with a 75:25 (v/v) solution of MeOH-H_2O. Reasonable accuracy is obtainable by the present method for use in environmental modeling purposes. Some disparities between results obtained with the present HPLC method on 25 organic compounds and those calculated from group additivity-constitutive factors are discussed.

81-2078. Di Corcia, A.; Samperi, R.; Sebastiani, E.; Severini, C. (Ist. Chim. Anal., Univ. Roma, I-00185 Rome, Italy) **Gas chromatographic analysis of water phenolic pollutants using acid-washed graphitised carbon black.** *Chromatographia* 14(2): 86-88; 1981 (6 references).

Good fractionation of 11 phenols was obtained using acid-washed, graphitized carbon black modified with 1,3,5-tricarboxybenzene and polyethyleneglycol 20M. Calibration data showed that phenols can be determined by gas chromatography at the 50 ppm level with good accuracy, except for 2,4-dinitrophenol and 4,6-dinitro-*o*-cresol (DNOC). For these 2 compounds, partial chemisorption on the column hinders correct determination at low concentrations. Other compounds studied included *o*-chlorophenol, phenol, *o*-nitrophenol, 2,4-dimethylphenol, 2,4-dichlorophenol, 2,4,6-trichlorophenol, 4-chloro-*m*-cresol, *p*-nitrophenol, and pentachlorophenol (PCP).

81-2079. Bilderback, D. E. (Dep. Bot., Univ. Montana, Missoula, MI 59812) ***Impatiens* pollen germination and tube growth as a bioassay for toxic substances.** *Environ. Health Perspect.* 37: 95-103; 1981 (23 references).

The germination and formation of pollen tubes of *Impatiens sultanii* Hook F. occurs rapidly in simple media at 25°C. The pollen tube growth rate of these flowering plants is linear for up to 1 hr under laboratory conditions. Formaldehyde at 7.5-10 ppm inhibited pollen germination, tube production, and tube lengths. At 0.5-20 ppm, 2,4-dichlorophenol inhibited pollen germination and tube production; at 25 ppm it inhibited tube growth. Germination and tube formation were inhibited biphasically by *p*-cresol

at 40-60 ppm and at 100-125 ppm. At 150 ppm, *p*-cresol inhibited tube lengths. Pollen germination and tube growth are unaffected by acrylamide (10-2000 ppm) and dioctyl phthalate (0.1-1.0 ppm). The advantages of using *I. sultanii* germination and tube growth as a bioassay mechanism for detecting toxic substances are discussed.

81-2080. Ascher, P. D. (Dep. Hortic. Sci. & Landscape Archit., Univ. Minnesota, Saint Paul, MN 55108) **Effects of exogenous materials on pollen tube growth in *Lilium longiflorum* pistils.** *Environ. Health Perspect.* 37: 107-115; 1981 (19 references).

The use of pollen tube growth in detaching pistils of the Easter lily, *Lilium longiflorum*, as an *in situ* bioassay for screening biologically active materials was investigated. Various antimetabolites, inhibitors, and miscellaneous materials were injected into the hollow styles of detached *L. longiflorum* pistils before, during, or after compatible or incompatible pollination. Pollinated styles were incubated at 22-23°C and pollen tube lengths were measured after 48 hr. Protein synthesis inhibitors decreased both compatible and incompatible pollen tube growth while RNA synthesis inhibitors significantly retarded the growth of compatible pollen tubes. Significant effects took place at lower concentrations when the inhibitors were injected at or after compatible pollination using stigmatic exudate as the vehicle. Pollen tube growth was significantly inhibited after injection of 2,4-dinitrophenol, mercaptoethanol, indolacetic acid, naphthaleneacetic acid, (NAA), benzyladenine, dimethyl sulfoxide, potassium iodide, or sodium iodide.

81-2081. Tsunenari, S.; Yonemitsu, K.; Uchimura, Y.; Kanda, M. (Dep. Legal Med., Med. Sch., Kumamoto Univ. Kumamoto 860, Japan) **The influence of putrefactive changes on the determination of paraquat in autopsy materials.** *Forensic Sci. Int.* 17(1): 51-56; 1981 (11 references).

Studies were conducted to determine the effects of putrefaction on the analysis of paraquat in autopsy materials. Twenty rats were dosed with 200 mg paraquat/kg body wt and sacrificed 15 hr later. Colorimetric analysis for paraquat was conducted immediately after death, and 1, 3, 5 and 7 days after death. Recovery of paraquat from the stomach and cecum decreased significantly after one day; by 7 days only 42 and 18% recovery was possible from the stomach and cecum, respectively. Paraquat levels in the liver increased by day 3, then decreased gradually. The results indicate that recovery levels of paraquat decrease with putrefaction of the cadaver. However, detectable levels remain 7 days after death.

81-2082. Os'kina, V. N. (Res. Inst. Ind. Hyg. Occup. Dis., Kiev, USSR) **Metod opredeleniya Furadana v vozdukhe pri primenenii granulirovannoi formy preparata. [Method of Furadan determination in the air during the use of granulated formulation of insecticides.]** *Gig. Sanit.* 46(2): 50-51; 1981 (Russian).

A method of determination of granulated formulation of the insecticide Furadan (carbofuran) in air is described. The method is based on reaction of azo dyes, with preliminary alkaline hydrolysis of Furadan. The products of hydrolysis are coupled with diazotized *p*-nitroaniline and then subjected to photocolorimetry. A direct relationship between the optical density of the solution and concentration was recorded within a 0.5-20-μg range.

81-2083. Shcherbina, O. N.; Kramarenko, G. V.; Popova, V. I.; Koval', N. A. (Med. Inst., Lvov, USSR) **Obnaruzhenie kotorana v vozdukhe i vode metodom khromatografii v tonkom sloe sorbenta. [Thin layer chromatographic determination of Cotoran in air and water.]** *Gig. Sanit.* 46(2): 51-53; 1981 (Russian).

Thin layer silica gel chromatography was used for determination of the herbicide Cotoran (fluometuron) in air and water. Carbon tetrachloride:diethyl ether (3:2) and methanol:toluene (1:4) mixtures were used as the solvents. Two methods were developed: the first was based on detection of Cotoran without hydrolysis, and the second method was based on detection of the product of Cotoran hydrolysis (trifluoromethylalanine). The sensitivity of the method was 5 μg.

81-2084. Newsome, W. H.; Shields, J. B. (Food Res. Div., Bur. Chem. Saf., Food Director., Dep. Natl. Health & Welfare, Ottawa, Ontario K1A 0L2, Canada) **A radioimmunoassay for benomyl and methyl 2-benzimidazolecarbamate on food crops.** *J. Agric. Food Chem.* 29(2): 220-222; 1981 (22 references).

A radioimmunoassay was developed which determines methyl 2-benzimidazolecarbamate (MBC) in evaporated ethyl acetate extracts of food crops without prior cleanup. Benomyl was converted quantitatively by the extraction procedures to MBC. Average recoveries from 8 commodities fortified with benomyl exceeded 90% and correlated well ($r = 0.99$) with those determined by cation-exchange liquid chromatography. (Author abstract reprinted by permission of the American Chemical Society)

81-2085. Iwata, Y.; Dinoff, T. M.; Bailey, J. B.; Voth, V.; Gunther, F. A. (Dep. Entomol., Univ. California, Riverside, CA 92521) **Analytical method for nitrapyrin and 6-chloropicolinic acid residues in strawberry fruit and soil.** *J. Agric. Food Chem.* 29(2): 235-239; 1981 (17 references).

Nitrapyrin [2-chloro-6-(trichloromethyl) pyridine], a highly specific nitrification inhibitor, is the active ingredient of N-Serve. Used as a preplant soil application at a

rate of 0.5 lb AI/acre (0.565 kg AI/ha), strawberry yields were increased by ~ 2.5 tons/acre. The increase was statistically significant at the 5% level for the 1977-1978 winter planting and at the 10% level for the 1978-1979 winter planting. Residue analytical methodology for nitrapyrin and its principal degradation product 6-chloropicolinic acid in strawberry fruit and soil is presented. No determinable residue of nitrapyrin (≥ 0.04 ppm) were detected in field-grown strawberries. The maximum level of 6-chloropicolinic acid found was 0.09 ppm in strawberries. Residue data for soil are also presented. (Author abstract reprinted by permission of the American Chemical Society)

81-2086. Buettler, B.; Hoermann, W. D. (Agric. Div., Ciba Geigy Ltd., CJ-4002 Basel, Switzerland) **High-pressure liquid chromatographic determination of captan, captafol, and folpet residues in plant material.** *J. Agric. Food Chem.* 29(2): 257-260; 1981 (7 references).

A specific method is described for quantitative determination of captan, captafol, and folpet residues in deciduous fruits, grapes, and cereals. The procedure involves the extraction of the samples with acetone and cleanup by partition between acetone-water and *n*-hexane. Individual cleanup procedures by column chromatography on silica are described for the separate determination of each of these fungicides. The simultaneous determination of captan, captafol, and folpet involves cleanup by gel chromatography. The fungicides are separated by high-pressure liquid chromatography on a cyano bonded phase and detected by conductivity measurement with a photoconductivity detector operated at 254 nm. Recoveries in the range of 75-120% indicate that these procedures are suitable for the residue analysis of these fungicides with detection limits of 0.02 mg/kg in fruit and grain and of 0.05 mg/kg in other plant materials. (Author abstract reprinted by permission of the American Chemical Society)

81-2087. Inman, R. D.; Kiigemagi, U.; Deinzer, M. L.* (Dep. Agric. Chem., Oregon State Univ., Corvallis, OR 97331) **Determination of chlorpyrifos and 3,5,6-trichloro-2-pyridinol residues in peppermint hay and peppermint oil.** *J. Agric. Food Chem.* 29(2): 321-323; 1981 (9 references).

Procedures are described for the determination of the insecticide *O,O*-diethyl *O*-(3,5,6-trichloro- 2-pyridyl) phosphorothioate (chlorpyrifos) and its metabolite 3,5,6-trichloro-2-pyridinol in mint hay and oil. After extraction, the chlorpyrifos residues are cleaned up on a silica gel column and quantitated by phosphorus-specific gas chromatography. The metabolite is separated from the extraction solvent by liquid-liquid partitioning with aqueous sodium carbonate, followed by chromatography on acid alumina. The column eluate is treated with *N,O*-bis(trimethylsilyl)acetamide and analyzed by electron capture gas chromatography. These methods are sensitive to 0.02 ppm in hay and to 0.1 ppm for the parent compound and 0.5 ppm for the metabolite in oil. Recoveries averaged 88%. (Author abstract reprinted by permission of the American Chemical Society)

81-2088. Rao, D. M. R. (Dep. Zool., Nagarjuna Univ., Nagarjunanagar 522510, India) **Improved cleanup technique for estimation of endosulfan residues from fish tissues under tropical conditions.** *J. Assoc. Off. Anal. Chem.* 64(2): 340-342; 1981 (9 references).

A new solvent system, 1% and 2% acetone in hexane, was developed for chromatography on partially inactivated Florisil to facilitate the separation of isomers of endosulfan and its metabolites from fish tissues under tropical conditions. By using a colorimetric method, the minimum detectable limit for each isomer of endosulfan in various fish tissues was found to be 5 μg. With this solvent system, the 2 isomers present in the technical material can be separated, so their toxicity to fish can be assessed separately. (Author abstract by permission)

81-2089. Jessee, J. A.; Valerias, C.; Benoit, R. E.; Hendricks, A. C.; McNair, H. M.* (Dep. Chem., Virginia Tech, Blacksburg, VA 24061) **Determination of cyanuric acid by high-performance liquid chromatography.** *J. Chromatogr.* 207(3): 454-456; 1981 (8 references).

This paper describes a high-performance liquid chromatographic method for the determination of cyanuric acid under anaerobic conditions. Cyanuric acid is used in the production of *s*-triazine herbicides and is also found as one of their degradation products. The method does not require derivatization, is sensitive, rapid, and allows detection of cyanuric acid in a defined microbat growth medium. The procedure for identifying the separate components involves the collection of separated peak fractions, evaporation of the fractions to dryness using a rotary evaporator, and placing the dried sample into the mass spectrometer sample holder. A UV spectrometer was used to determine the maximum absorbance and molar absorptivity as 214 nm and log 4.00 at pH 8.00, respectively.

81-2090. Roseboom, H. (Unit Residue Anal., Natl. Inst. Public Health, NL-3720 BA Bilthoven, The Netherlands) **Determination and confirmation of binapacryl and dinobuton residues on apples and cucumbers by high-performance liquid chromatography.** *J. Chromatogr.* 208(1): 137-140; 1981 (5 references).

A method is described for the determination of dinobuton and binapacryl. Due to the polar nature of the compounds, high-performance liquid chromatography was chosen for the final determination. Extraction of binapacryl and dinobuton with hexane + light petroleum gives good recoveries in most cases, with a minimum of in-

terfering substances being co-extracted. The recoveries, however, tend to vary with variety and maturity of the crop, especially with apples. The addition of methanol to the extracting solvent made recovery reproducibility better than 90%. Column clean-up on neutral aluminum oxide was very effective in removing interfering substances. Care should be taken not to overload the column with too much material. In the liquid chromatographic system used, dinobuton and binapacryl gave well-separated, symmetrical peaks. At the detection wavelength used, the sensitivity was very good; minimum detectable quantity was 1 ng/injection. When detection was carried out at 254 nm, the minimum detectable quantity was about 2 ng. For binapacryl at a maximum residue limit of 0.3 mg/kg, the coefficient of variation was 5%. For dinobuton at a maximum residue limit of 1 mg/kg, the coefficient of variation was also 5%.

81-2091. Realini, P. A. (Altex Sci., Berkeley, CA 94710) **Determination of priority pollutant phenols in water by HPLC.** *J. Chromatogr. Sci.* 19(3): 124-129; 1981 (13 references).

Phenols are often detected in industrial wastes due to their widespread use as intermediates in the production of plastics, pesticides, drugs and dyes. A method for identifying phenolic compounds in water at the ng/l level by high pressure liquid chromatography is described. Eleven standard phenolic compounds including dinitrophenol, *p*-nitrophenol, pentachlorophenol (PCP) and 2,4,6-trichlorophenol were separated using a MicroPak 5 micron C18 column with an acetic acid : water : acetonitrile eluent. A two-step extraction with methylene chloride using a cationic ion-pair reagent was utilized to concentrate the samples and identification of the compounds was accomplished by a dual UV detector. Recoveries for 10 of the compounds studied were > 90%. Recovery of phenol itself was 75%.

81-2092. Wells, D. E.; Johnstone, S. J. (Freshwater Fish. Lab., DAFS, Pitlochry, Scotland) **High performance liquid chromatography of polychloro-2-(chloromethyl sulphonamido) diphenyl ethers and their impurities in the mothproofing agent, Eulan WA New, and in water.** *J. Chromatogr. Sci.* 19(3): 137-143; 1981 (20 references).

The high-performance liquid chromatographic analysis of the active ingredients polychloro-2-(chloromethyl sulfonamido) diphenyl ethers (PSCDs) and polychloro-2-amino diphenyl ether (PAD) impurities in the moth proofing agent, Eulan WA New, is described. Samples of natural waters suspected of containing Eulan WA New were extracted using DC-200 coated polyurethane foam plugs. The extraction procedure was pH-dependent and the resulting plug extract was cleaned up on a layered acidic and basic alumina column. After elution with solvents of different polarities and acidities, the samples were blown to dryness and reconstituted in methanol for analysis by high performance liquid chromatography. Recoveries of PCSDs from spiked distilled water ranged from 91 to 99%, while those of the PADs ranged from 80 to 116%. The effects of solvent composition, pH, column packing, detector wavelength, and the use of an internal standard on the process are also considered.

81-2093. Malaiyandi, M.; Benoit, F. M. (Environ. Health Cent., Health & Welfare Canada, Ottawa, Ontario K1A OL2, Canada) **Ultra-pure reagents for trace analysis of non-polar organic contaminants in environmental media.** *J. Environ. Sci. Health A* 16(2): 215-250; 1981 (24 references).

Problems due to commercially available hexane, anhydrous sodium sulfate, sodium bicarbonate and water in the gas chromatographic analysis of environmental contaminants, such as organochlorine pesticides, are described. Such analyses require stringent standards of purity of the solvents and reagents used and pesticide-grade reagents were found unsuitable for ultra-trace analysis of pollutants. The identification of some of impurities present in commercial products by GC/MS and methods for purifying these reagents for pesticide residue trace analysis are outlined.

81-2094. Freidlina, R. K.; Dostovalova, V. I.; Kuz'mina, N. A.*; Chukovskaya, E. C. (Inst. Org. Element Compd., USSR Acad. Sci., Moscow, USSR) **Carbon-13 NMR spectra of DDT, its analogues and related compounds.** *Org. Magn. Reson.* 15(2): 133-138; 1981 (20 references).

Side chain substituent effects on ring carbon atom shifts in 33 mono- and disubstituted benzenes, including DDT, its analogs, homologs and derivatives, were examined. Mono- and disubstituted aromatic compounds, with 2 different substituents in the α- and β-positions of the side chain, demonstrated that the substituted ring carbon atom shifts follow the additivity rule and can be calculated from substituent increments. The chlorine atoms in an α-position to the phenyl ring gave rise to an additive α-effect of about 25 ppm, as in perchloralkanes. The influence of a β-chlorine atom in the side chain on the substituted carbon atom in the ring was only 3 ppm, as opposed to a value of about 10 ppm for the β-effect in alkyl chains. The first β-chlorine substituent had no noticeable influence on the substituted ring carbon chemical shift. Ring substituted carbon atom signal shifts caused by the γ-effect of chlorine in the side chain were similar to those observed in aliphatic chains. The *o*-chlorine substituents shift the side chain α-carbon atom signal higher by 3.6-5.2 ppm compared to *p*-chlorophenyl compounds.

81-2095. Sundaram, K. M. S. (For. Pest Manage. Inst., Sault Ste. Marie, Ontario, Canada) **Analysis of aminocarb and its fate in a forest environment.** *Proc. Symp. Aminocarb, 1978.* pp. 11; 1980.

An analytical method is reported for monitoring the amount of aminocarb present in different environmental samples after operational spray applications. Steps included are solvent extraction, acid/base and aqueous/non-aqueous partitions, clean-up and final quantification either by derivatization and using electron capture GLC or directly injecting the cleaned extract into a GLC fitted with a Hall detector operating in nitrogen mode.

81-2096. Mamarbachi, G. (Serv. Prot. Environ., Ste. Foy, Quebec, Canada) **Recherche et dosage des residus d'aminocarb dans l'environment forestier par chromatographie en phase gazeuse. [Gas chromatographic study and determination of aminocarb residues in a forest environment.]** *Proc. Symp. Aminocarb, 1978.* pp. 12-30; 1980 (16 references) (French).

The study was undertaken, following the spraying of 3×10^6 acres of Quebec forests with aminocarb (to control tortricid infestation), with the view of finding a method which would permit determination of residue effects on aquatic and terrestrial life. Extraction, purification and chromatography are described. Aminocarb can be injected directly into the chromatograph without decomposing if certain conditions are met. The compound is more stable on 3% OV-17 than on 4% OV-101 + 6% OV-210 at temperatures exceeding 130°C. A specific nitrogen and phosphorus detector is superior to other detectors sensitive to nitrogen. The extraction and purification procedure permits the detection of very low aminocarb concentrations. Detection threshold is 0.1 ng.

81-2097. Brun, G. L.; MacDonald, K. M. (Environ. Canada, Moncton, New Brunswick, Canada) **Analysis of aminocarb in water and sediments by gas liquid chromatography and high performance liquid chromatography.** *Proc. Symp. Aminocarb, 1978.* pp. 31-47; 1980 (9 references).

Two methods have been developed to analyze aminocarb directly, without derivatives, from water and sediment. Gas liquid chromatography is used effectively without any noticeable decomposition, using the nitrogen specific Hall Electrolytic Conductivity Detector. Reverse-phase high performance liquid chromatography with UV-detection is also used and appears to be a better method, due to its versatility in analyzing combinations of the metabolites along with parent compound. Both the conventional serial solvent extraction or the XAD-7 macroreticular resin are effective in recovering aminocarb and metabolites.

81-2098. Shustrov, V. S.; Zelenina, M. F.; Kulintsova, E. V. (All-Union Res. Inst. Plant Prot., Leningrad, USSR) **Opredelenie Nortrona v vode, pochve i svekle. [Nortron determination in water, soil and sugar beet.]** *Sakh. Svekla* (2): 39-40; 1981 (Russian).

Chromatographic determination of the herbicide Nortron (ethofumesate) in water, soil and sugar beet is described. The method is based on Nortron extraction with *n*-hexane or diethyl ether, purification and thin layer silica gel chromatography. The detectability of Nortron was 80-95%. The sensitivity of the method was 3-5 μg/sample.

81-2099. Ohsaku, M.; Shigemi, S.; Murata, H.; Imamura, A. (Dep. Chem., Fac. Sci., Hiroshima Univ., Higashisenda, Hiroshima 730, Japan) **A quantitative analysis of the through-space and the through-bond interactions between lone-pairs and σ-frames: s-triazine and s-tetrazine.** *Tetrahedron* 37(2): 297-306; 1981 (15 references).

The quantitative evaluation of through-bond or through-space orbital interactions was attempted by using localized molecular orbitals (LMOs) transformed from canonical molecular orbitals (CMOs). CNDO/2 and INDO calculations were performed on *s*-triazine and *s*-tetrazine. The *s*-triazine had 3 lone-pairs in a molecule, which could be combined into 3 combinations. Among these 3, 2 degenerated when the whole interaction conserved its molecular point symmetry. The *s*-tetrazine had 4 lone-pairs, which could be transformed into 4 combinations. The energies of these orbitals exhibited interesting behavior. The results were subjected to analysis from the standpoint of the through-space and through-bond interactions using localized molecular orbitals. The interactions were expressed by several interaction terms. It is suggested that this procedure will be useful for explaining the reactivity and reaction path of addition reactions.

81-2100. Pus'mennaya, M. V. (Lab. Anal. Chem. Pestic., All-Union Res. Inst. Hyg. Toxicol. Pestic. Polym. & Plast., Kiev, USSR) **K analizu fosforganicheskikh pestitsidov khromatoenzimnym metodom v produktakh pitaniya i biosubstratakh. [Use of a chromatoenzymatic method for analysis of organophosphorus pesticides in food products and biosubstrates.]** *Vopr. Pitan.* (1): 69-71; 1981 (14 references) (Russian).

A highly sensitive chromato-enzymatic method is presented for determination of organophosphorus pesticide (OPP) residues in food products and biological substrates. The method is based on the ability of OPP to inhibit cholinesterase activity. Prior to determination, pesticides are fractionated in the sorbent layer. The sensitivity of the technique is 0.001-0.01 μg/kg.

See also 81-1803, 81-1805, 81-1815, 81-1817, 81-1818, 81-1819, 81-1820, 81-1821, 81-1822, 18-1823, 81-1824, 18-1825, 81-1826, 81-1827, 81-1828, 81-1829, 81-1856, 81-1877, 81-1881, 81-1883, 81-1884, 81-1885, 81-1888, 81-1973 *and* 81-2007.

☆U.S. GOVERNMENT PRINTING OFFICE: 1981-341-831/51

The Administrator of the U.S. Environmental Protection Agency has determined that the publication of this periodical is necessary in the transaction of public business required by law of this Agency. Use of funds for printing this periodical approved by the Director of the Office of Management and Budget February 6, 1973.

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